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# THE TYPHOID TOLL

By George A. Johnson

Certain cardinal facts stand forth in opening a discussion of the significance of typhoid fever. First of all, let it be clearly understood that there is no question of its being an entirely preventable disease. Second, that all typhoid is caused by taking the typhoid germ into the mouth. And, third, that typhoid fever in America is the chief disease conveyed by impure food and drink.

These premises stated let us go a little further in the line of elaborating on these basic facts. Since the disease cannot be contracted naturally without taking the specific germ into the mouth, and since the manner in which this act is commonly performed can be said to be associated almost exclusively with the consumption of typhoid infected food and drink, it follows that to eradicate the disease involves only the exercise of really simple measures of precaution, which, in the concrete, are to see to it that the food and drink be pure, or made pure, and kept pure until consumed. Public understanding of this need is, of course, in the ideal sense, imperative, but when once the typhoid scourge has been placed under control, it is possible for public health authorities to prevent the reëstablishment of its sinister influences on the public health, in spite of the ignorance, selfishness, or almost unbelievably complacent tolerance of the public itself.

It is not for a moment denied that to effect this idealistic result is an undertaking beset with tremendous difficulties. The public is not to be blamed unqualifiedly for individual or collective responsibility in the maintenance of this filth disease among human kind. Education must be forced upon the public by those qualified to teach; public health officials must be given wider power through more exact and far-reaching laws aimed at the destruction of the roots of this filth-sustained plant; and ample funds must be appropriated to carry through the work. The vital capital needlessly dissipated by the typhoid scourge in this country amounts each year to not less than $150,000,000, yet the combined annual appropriations for all the health departments of the cities of the United States amount to less than 30 cents per capita, or not more than $15,000,000. This fund is made to cover the expenses of work on infant morbidity, inspection of school children, laboratory and dispensary service, tuberculosis, and for educational and publicity work, and this sum is clearly inadequate for the efficient prosecution of tuberculosis work alone. In New York City a very large share of the expense of such work is borne by the Department of Charities. Probably not 10 per cent of the health department funds are devoted to holding typhoid fever in check; the prevention fund, if you like. Such an amount would be equal to 1 per cent of the loss suffered through failure to exercise adequate and efficient measures of prevention.

Public health officials realize this unsatisfactory state of affairs, but if insufficient power is given them under the law, and if they are hampered by lack of funds and competent helpers to do the things they know are necessary, who is to blame? The annual budgets, with very few exceptions, are made up by officials who sense but dimly the responsibility they shoulder when they cut the health department appropriations to the very quick. Ignorance on their part of the reasons why heavy expenditures for disease prevention are justified is largely responsible for this; and the average health official realizes only too clearly how wellnigh impossible it is to obtain for his work even a reasonable approximation of what his department could make very good use of. The soundest argument for larger appropriations to place before the arbiter of state and municipal financial expenditures is a statement of what preventable disease actually costs in dissipated vital capital. A city of 100,000 people, with an annual typhoid fever death rate of twenty, suffers an annual loss of vital capital from this disease alone amounting to $150,000. In view of the indisputable fact that typhoid fever is preventable, the actual loss of this amount of vital capital through failure to provide sufficient means to effect such prevention, is mighty poor financial management. And yet dozens of cities do experience as great, or an even greater proportional loss in this way each year. The present day typhoid toll of New York City, expressed in lost vital capital, amounts to $4,000,000 annually.

If the adjuster of a municipal or state budget were knowingly threatened with illness, or one of his immediate family so affected, he would not hesitate to spend any reasonable sum of money to defray the cost of obviously necessary preventive measures. Life insurance certainly is popular, and it is not to be supposed that the officials of city and state finance departments are immune to the persuasive arguments of life insurance agents. This is protection against the effects of disease, nevertheless such officials wield an energetic blue pencil when they reach the health department item in the annual budget. They cannot see the return of good to the public, even though they realize the protection afforded to themselves and their families from their life insurance, or they would not pay the premiums.

Until one near and dear is attacked by typhoid fever its repulsiveness and fatality are not seriously viewed. To an individual who has it, typhoid fever is no joke. To those who have never experienced it personally, or viewed its effects, it is often dismissed metaphorically with an airy wave of the hand, as being largely one of those children of the imagination of sanitarians who derive profit from the preaching of the doctrine of prevention, and who endeavor, through the exercise of meretricious reasoning, to deprive the public of the comfortable, sovereign privilege of insanitary habits.

The general public, eliminating, of course, those individuals who have learned by sad experience, rarely gives a thought to the possible disease bearing properties of the two essentials to human existence, drink and food, unless these commodities actually are repulsive to the senses. There is tacit knowledge that such matters are controlled by some mysterious, yet real, authority, hence blind confidence impels the public to take things as they come, and we well know with what disastrous results sometimes. Yet how can the public protect itself where individual ignorance obtains, and when the health authorities cannot, or do not, exercise proper vigilance in preventing the delivery to the people of impure water, milk and other foods?

The traveler steps aboard a fast express with no concern except a desire that his accommodations be satisfactory, and that the train may arrive on time, yet his life and those of hundreds of fellow travelers are in the hands of the engine driver and other employees of the railroad company. One lapse of vigilance, one disobeyed order, one signal ignored, and those lives are dashed into eternity, and the maimed bodies of those who escape death are sentenced to a lingering life of pain. And it is noteworthy that where one passenger is killed in a train accident one hundred are killed by typhoid fever. Every normal individual freely walks the streets of his city, and repeatedly, day after day, steps upon shaky and rattling sidewalk gratings with never an apprehensive thought of their possible instability. This is but another exemplification of the customary blind confidence of the public in its officials, and it is generally admitted that municipalities are not so efficiently managed as privately owned companies, although this statement is by no means to be taken as a gratuitous condemnation of municipal ownership.

Twenty millions of people in the United States are now being furnished with filtered water at a cost not exceeding $8,000,000, or 40 cents per capita, per year, and in these cities having filtered supplies the water borne typhoid fever has been practically eliminated, as reliable statistics abundantly prove. Inexpensive as water purification is these people are spending more money for that alone than they appropriate for the work of prevention and public treatment of all diseases, whether water borne or not, and it is not to be forgotten that out of the public health fund comes a considerable expenditure for work in the line of the conservation of purity of public water supplies.

The results of water purification always show a big balance on the right side of the ledger. Where one dollar is spent for pure water many dollars are saved in the form of vital capital through the prevention of sickness and death. If a community of 19,000 people spends each year 40 cents per capita for filtered water, and thus each year prevents a single death and the attendant cases of illness from typhoid fever, it will come out even financially, and increase its self-respect into the bargain. In Pittsburgh, to cite a well known example, the adoption of water filtration has saved over 600 lives, 9000 cases of typhoid illness, and $4,500,000 in vital capital annually.

Three hundred thousand persons suffer annually from typhoid fever in this country, and 20,000 die of it. This means that in the course of a decade one person in every 33 contracts typhoid fever by taking into the mouth germs discharged in human urine and feces. Of those who recover a substantial number die later from other causes leading out of a depleted vitality. Still others never completely recover from its effects, and, although they may live to old age, their usefulness has been materially curtailed. To give for each human life lost through typhoid fever an average value of $3600, and for lost wages and medical attendance $200 per case, the present day annual typhoid toll in the United States amounts to $130,000,000. It would seem that the influence of depleted vitality in the case of typhoid convalescents resulting in earlier deaths from other causes, and depreciation of usefulness through the years of remaining life, should be given some expression of money value, and if for this even $75 is allowed for each typhoid convalescent the final result is $150,000,000, as representing, in terms of dissipated vital capital, the annual typhoid toll paid by the citizens of the United States each year. The compulsory tribute paid by the Athenians to the Minotaur was considered noteworthy, but by comparison this mythical sacrifice for a fixed purpose sinks to insignificance beside the real and needless sacrifice of the present day in this country to a force which derives its power from such unenviable sources as lassitude, ignorance and filth.

Whose is the responsibility? Who can be blamed for permitting typhoid fever to exist and thrive in this enlightened age? Is it the national government, the state governments, the municipal governments, or the people themselves?

There is no law prohibiting the consumption of impure water or food unless the consumer deliberately contemplates suicide. The average state cannot, or, to say the least, has not thus far been signally successful in so doing, force a city within its boundaries to cease allowing impure water and food to be furnished to its citizens. The national government has no control over health matters in any individual state. Each state is a power within itself, in this regard, and in a very large measure each city also, and each individual citizen as well.

The national government has a certain sort of control over boundary waters, but here its effect on the public health is virtually negligible, and otherwise, at the most, it exercises but a paternal influence in questions of pure food and drink. The state health departments, with their limited funds and power, do much good in encouraging the purification of polluted water supplies, the sanitary disposal of sewage and refuse, the prohibition of adulteration of foods, and, largely by moral suasion through the admirable medium of education, exert a generally benign influence in other lines of disease prevention. The city health departments, having a narrower field to cover, probably accomplish more visible good, and when such departments are in the hands of competent officials, and when the available funds are an appreciable fraction of what they should be, and where the local officials have the sympathetic coöperation of the state authorities, the results accomplished have been all that reasonably could be expected.

TABLE 1

*Estimated value of human life and of lost wages and medical attendance in cases of typhoid fever*

| AGE | PER CENT OF DEATHS FROM TYPHOID FEVER | TOTAL DEATHS FROM TYPHOID FEVER | ESTIMATED VALUE OF HUMAN LIFE |
|---|---|---|---|
| *years* | | | |
| Under 5 | 5.5 | 1,100 | $400 |
| 5 to 9 | 6.0 | 1,200 | 1,800 |
| 10 to 19 | 20.5 | 4,100 | 3,600 |
| 20 to 29 | 29.0 | 5,800 | 5,000 |
| 30 to 39 | 17.0 | 3,400 | 4,200 |
| 40 to 49 | 10.0 | 2,000 | 3,600 |
| 50 to 59 | 6.5 | 1,300 | 3,000 |
| 60 to 69 | 3.5 | 700 | 1,200 |
| 70 and over | 2.0 | 400 | — |
| Totals and Averages...................... | | 20,000 | $3,600 |

For each typhoid death count fifteen cases. Medical attendance, nursing, medicines, etc., taken at $100 for each case of typhoid. Lost wages for two-thirds the cases with ages from ten to sixty years at $14 per week for twelve weeks (representing the "workers" but not necessarily the "wage earners") averages $100 each for all cases. Then add $75 per convalescent case for depreciated vitality. The sum total vital capital loss from one typhoid death is $7500.

We elect our state and local officials, or at least some of us labor under the fond belief that we do, and they in turn appoint our health officials. The amount of money which these officials are able to obtain for the maintenance of their departments often depends, sadly enough, not so much on what happen to be the needs of the department, as on the persuasiveness of the head of the department.

In the last analysis, education respecting health matters is the light which eventually will lead us out of the insanitary wilderness. Almost every year sees an improvement, but except in the field of water purification, wherein the past fifteen years have seen stupendous advances, other lines of disease prevention work, allied to impure foods, with some exceptions in the case of milk, have not advanced a fractional part of what they should; and lack of public realization of the controlling conditions is chiefly responsible for this deplorable state of affairs.

The annual budget is usually scrutinized with the temper of the public in mind. How often we see published the vainglorious statement that "The tax rate of Utopia will not exceed so many mills this year." This is a plea for public recognition of the care with which the city officials are spending the people's money. To keep the tax rate down how many lives are uselessly sacrificed? On what important governmental department appropriation is the blue pencil used more freely than that of the department of health, unless it be a public works department appropriation for water purification? Can any reasoning mind fail to see that when once enough money has been appropriated to the health department for the proper furtherance of measures of prevention against disease, each year should see this appropriation maintained in proportion to the increase in population?

The department of publicity and education of the state board of health of New York heads its bulletins in the following manner:

"Public health is purchasable. Within natural limitations any community can determine its own death rate."

Every individual is supposed to have a wholesome fear of disease, and at least some regard for its fatal possibilities, therefore if the campaign of education were carried far enough individuals would be advised how to avoid disease and preventable death. No better public educational system has been devised that does more good than the health exhibits prepared for public study, and even sometimes carried, by the medium of special cars, to the very homes of the people. To protect the health of the public gentle persuasion must first be given a trial, and, finally, if that is unheeded, compulsory observance of sanitary customs must be resorted to.

Sanitation through the agency of publicity campaigns is the best medium we have. But it is another case of the horse and the water. The most inspiring and convincing arguments may be spread on paper and widely distributed, but as a class the people will not read them and be instructed. To follow the instructions set down in these bulletins means some sort of curtailment of the personal license which the American public regard as one of the chief benefits of a free country. The line between liberty and license is nowhere so loosely drawn as in this country.

The widespread enforcement of the anti-spitting law gained favor, not so much because the rank and file of the people really believed that disease was spread in this manner, as for the reason that the act and effect of its practice were repulsive. Individuals, and not classes, are affected by this law and in public obey it fairly well, yet the same individuals sewer from their cesspools, and cities discharge their huge volumes of sewage, direct into waterways from which other communities draw their water supplies. There are just as strict laws governing such violations of one of the most elementary laws of nature, yet the individual violator is almost never punished, and the collective violator, while sometimes brought to the bar of justice, usually is discharged with a naughty boy reprimand on the giving of promises to remedy the evil, and in which promises, even as he gives them, he ofttimes makes mental reservations to keep only when he can no longer avoid keeping them.

Several centuries ago Samuel Butler had a clever idea of health Utopianism, and obviously meant what he said even though his views were expressed in a clearly satirical manner. Writing of his visit to the mythical country Erewhon, he records his impressions that in that country if a man contracted a disease, or failed bodily before he was seventy years old, he was adjudged a criminal and dealt with accordingly; whereas if he merely forged a check, fired a house or did any of those things which, by us, are considered criminal, he was taken to a hospital and tenderly cared for at the public expense, the assumption being that he was suffering from a severe fit of immorality. He was visited by his friends who inquired with great solicitude how it all came about; what impelled him to forge the check, set fire to his neighbor's house, or what not, and the whole problem was thoroughly threshed out without reserve.

Butler records his experiences in a court in Erewhon where he saw prisoners being sentenced for injuring their health. To one particularly hardened criminal the judge said:

> Prisoner at the bar, you have been accused of the great crime of laboring under pulmonary consumption, and, after an impartial trial by your countrymen, you have been found guilty. This is not your first offense; you have had a long career of crime. You were convicted of aggravated bronchitis last year; and I find that, although you are now only twenty-three years old, you have been imprisoned no less than fourteen times for illness of a more or less hateful character.

In Erewhon, it appears, if a man permitted his health to run down he was counted a greater criminal than the man who merely burned down his neighbor's barn or stole his cattle. His health was a part of the state's assets, and if he allowed it to deteriorate he defrauded the state. In a broad sense why is not this viewpoint entirely reasonable? If it should become the custom to handle health matters in this manner a tremendous impetus would be given to all lines of preventive medicine, practiced by the layman as well as the professional sanitarian.

The prosperity of a nation depends upon its productive power, and it hardly can be considered good business policy to submit to a depletion of that power many times in excess of the cost of its conservation, and resulting from the failure of the public to realize the truth. In the interests of the nation it is imperative that they be brought to a sense of realization of it, and that if they cannot or will not be taught, the interests of the nation demand that country-wide changes in the present modes of insanitary living be forced, and the public be made to understand that in some things they must be guided by others without asking, or perhaps reasoning, why.

## FACTORS TENDING TO SUPPORT THE PERSISTENCE OF TYPHOID FEVER

A significant fact disclosed by a study of the mortality statistics of the United States is that in rural districts, that is, where the population of communities is less than 2500, typhoid fever is more prevalent than in urban districts, although the combined mortality from all causes is greater in cities. Occasionally this rule may not hold, as perhaps in the case of New York for last year, when the rural combined death rate of New York State was in excess of that of New York City; but generally it does.

What, then, are the reasons why typhoid fever is more prevalent in rural districts than in urban districts? To the sanitarian this is no mystery. In rural districts the individual is a plenary power unto himself. In small communities the appropriations made for disease prevention work are trifling, and to attempt by innocuous persuasion the observance of regulations looking to more sanitary modes of living, and thereby summarily alter the practice of customs observed for generations, is sometimes sufficient to arouse antagonism on the part of the individuals affected pronounced enough in itself to preclude the establishment of different, and better, practices, the acceptance of which, with sympathetic coöperation on the part of the individuals, would do untold good.

The farmer, living isolated from his fellows, usually considers that he is sufficient unto himself. He obtains his drinking water from the most convenient source, which usually is a shallow well often located nearby his barnyard or privy, and thus open to dangerous contamination. The contents of his privy are never buried as a safeguard against disease, for his economical mind rebels against the waste of good fertilizing material. Hence it is spread upon his garden plot from which come the vegetables for his table, often to be eaten uncooked, and certainly always likely to be polluted. He considers not at all the fly menace, and aside from providing screens for his windows and doors, more for the exclusion of mosquitoes than flies, and which often keep more flies in than out, he regards the ubiquitous insect with tolerance, and calmly divides his food and drink with him without more than a petulant display of temper when a fly takes it into his head to fall into his milk, or become entangled in his butter or gravy. In some communities the consumption of corn on the ear takes on the aspect of an indoor sport, the human animal and the insect entering into friendly competion to ascertain who will get it first.

The ruralite is not particularly concerned if his sink, privy or barnyard drainage discharges into a brook from which his lower down neighbor takes his water supply. In fact, it is considered good rural engineering to lead such drainage direct to the nearest waterway. It would take a person of high intelligence and eloquence to teach convincingly the truth or logic of riparian rights to the average farmer, who is so prone to believe that it is wise to "Be not the first by whom the new is tried."

The greater prevalence of typhoid fever in rural districts, therefore, is due, primarily, to ignorance. If the people of one generation could be taught to believe that the house fly is a menace to health, and an especially active agent in the transmission of typhoid infected material; that a well located so that it can receive the drainage from the sink, privy and barnyard is a constant element of danger; that milk is a very favorable medium for the growth of the typhoid germ, and therefore should be collected with the greatest care and never handled by persons who are sickly, who come in contact with sick people, or who have had typhoid at one time or another; that garden truck should never be fertilized with human excrement; then each rural inhabitant would become a barrier in himself to the spread of typhoid fever, and benefit not only himself and his family, but the public at large. As it is, when persons so benighted become public purveyors of green vegetables and dairy products, a promising factor is introduced in favor of the propagation of typhoid fever. The high typhoid fever death rate in rural districts is due chiefly to the direct "from me to you" method of infection, and whether through the agency of bad water, flies or dirty hands, the typhoid germ has a much shorter and less difficult road to travel in the country than it has in the city.

## HEALTH DEPARTMENT INADEQUACY

When heading this section the author was tempted to substitute inefficiency for inadequacy, because of the self-evident fact that most health departments, municipal and state, *do not* possess the power to act effectually. But inadequacy seems to fit the case less offensively as indicating that such boards as a whole, but largely through no fault of theirs, are not equal to the requirements.

It is nevertheless true that some health departments are neither headed nor manned by persons well qualified by knowledge, experience and energy to perform the highly responsible duties required of them. Unless a young man possesses independent means, or is of a philanthropic turn of mind, the salaries offered in health department work are such as promptly to discourage him in any fond dream of speedily acquiring the competence of a millionaire; but with the prevailing appropriations it cannot be otherwise.

It is a fact, perhaps not realized except by a few, that no thoroughly competent municipal or state department head fills that position except at a personal financial sacrifice. Where an official possesses the knowledge and experience competently to fill the position as chief of such a department, the salary offered is but a comparatively small measure of the financial return the same ability would command in private practice. Lack of satisfactory financial lubrication does not tend to make the machinery of the department run more smoothly or painstakingly, and the results accomplished by a year's hard work are so far removed from the spectacular, and therefore incapable of popular exploitation and comprehension, that they more often than otherwise go down to history "unhonored and unsung."

Occasionally, however, such epoch marking accomplishments as those of Jenner, Pasteur, Koch, Reed and more recently that of Gorgas in Panama, thrust before the reluctant-to-believe public mind the realization that a great step has been taken in conserving the health of mankind. But the road of the health official is usually a dreary one, unlightened even by an occasional fringe of primroses in the way of public commendation, and is made so by reason of the fact that it is his chief duty to prevent disease, and the measures of prevention are commonly distasteful to the public in whose interests he is acting. A successful year's campaign against filth in a city of 100,000 persons, resulting in the saving of a hundred lives, is publicly rewarded by a brief newspaper paragraph to the effect that the death rate has been reduced from 15 to 14 per thousand population, and is as promptly forgotten, if read at all. Few laymen realize that in thirty-three large world cities the annual general death rate has been lowered 37 per cent in the past thirty years. New York City's annual death rate has been nearly cut in half in that period. All this is lasting proof of the effects of better living, better understanding on the part of the public, better medical treatment of sickness and the wider exercise of measures of prevention. This last refers very prominently to purer water supplies, which item in itself, in the last thirty years, has been the means of a material reduction in the typhoid fever death rate in the United States as a whole, and in the cities which have adopted filtration the water borne typhoid has been practically stamped out.

The ways of public health work are sometimes devious, and often obscure. They cannot readily be understood by the layman. Therefore such financial support as health departments receive from the public comes more or less grudgingly, even though the results obtained far outbalance the cost. Most of the diseases well understood by scientists are caused by a specific germ, and millions of such germs may be placed on the head of an ordinary pin, yet the havoc they can wreak, tiny as they are individually, is measurable only by comparison of their size with the pyramids of Gizeh. The lay mind can comprehend a visible menace against his life, like a moving vehicle or a club in the hands of an enemy, and will take steps to avoid it, but an enemy which must be magnified a thousand diameters that he may see it is beyond his understanding, and this is the enemy to mankind around which this paper is written.

## HEALTH DEPARTMENT APPROPRIATIONS

For some reason, which patently has no good financial foundation, the amount of health department appropriations generally varies as the size of the city, that is, the larger the city the higher the per capita appropriation, as shown in the accompanying table. The budget adjusters evidently conclude that the smaller the city the less need there is for disease prevention.

These gentlemen, if examined on the point, might say, if they knew anything about it, that Augusta, Georgia, with an annual per capita health department appropriation of $0.61, is quite as well off as Memphis, Tennessee, with one of $0.93, since the general death rate is about the same in both cities, being a little lower, in fact, in Augusta. Aurora, Illinois, and South Bend, Indiana, appropriate $0.03 per capita for health department work, yet their annual death rate from all causes is 6 per cent lower than in New York City, where the health department appropriation amounts to $0.58 per capita. Easton, Pennsylvania, appropriates $0.02 per capita as compared with $0.61 in Pittsburgh, but the total death rate in both cities is about the same. On the other hand Seattle, Washington, where the health department appropriations are more liberal than in any other city in this country, amounting to $0.98 per capita, has a death rate only 43 per cent as great as Lewiston, Maine, which is one of the stingiest cities in this respect, the appropriation there being but $0.06 per capita per annum.

## TABLE 2

*General death rates in large world cities based upon total deaths from all causes*

| CITY | GENERAL DEATH RATES PER 1000 POPULATION LIVING | | | | | | | | | | | | | | PER CENT DECREASE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Averages | | | | | | 1909 | 1910 | 1911 | 1912 | Averages | | | | |
| | 1881 to 1885 | 1886 to 1890 | 1891 to 1895 | 1896 to 1900 | 1901 to 1905 | 1906 to 1910 | | | | | 1881 to 1890 | 1891 to 1900 | 1901 to 1910 | 1911 to 1912 | 1881–1885 to 1910–1912 |
| Amsterdam | 25.1 | 22.4 | 19.2 | 16.7 | 14.7 | 13.1 | 13.1 | 12.2 | 12.4 | 11.2 | 23.7 | 17.9 | 13.9 | 11.8 | 53.0 |
| Belfast | 24.7 | 24.4 | 25.1 | 23.4 | 20.8 | 19.6 | 18.2 | 18.6 | 17.2 | 18.1 | 24.5 | 24.2 | 20.2 | 12.6 | 49.0 |
| Berlin | 26.5 | 22.4 | 20.5 | 18.1 | 17.0 | 15.5 | 15.1 | 14.7 | 15.6 | 14.4 | 24.4 | 19.3 | 16.2 | 15.0 | 45.0 |
| Breslau | 31.3 | 28.8 | 27.4 | 25.0 | 23.7 | 21.2 | 20.3 | 19.1 | 19.5 | 18.4 | 30.5 | 26.2 | 22.4 | 18.9 | 39.0 |
| Brussels | 23.4 | 21.2 | 20.2 | 17.2 | 15.2 | 14.1 | 13.9 | 13.6 | 13.9 | 13.5 | 21.8 | 18.7 | 14.6 | 13.7 | 41.0 |
| Budapest | 31.5 | 30.8 | 25.5 | 21.6 | 19.8 | 19.5 | 19.2 | 19.3 | 19.4 | 18.5 | 31.1 | 23.5 | 19.6 | 18.9 | 40.0 |
| Christiania | 19.9 | 22.3 | 19.0 | 17.5 | 15.3 | 13.0 | 12.7 | 11.9 | 13.5 | 13.4 | 21.1 | 18.2 | 14.1 | 13.4 | 32.0 |
| Copenhagen | 22.3 | 22.3 | 20.2 | 17.6 | 16.1 | 15.1 | 14.5 | 14.2 | 14.8 | 14.1 | 22.3 | 18.9 | 15.6 | 14.5 | 35.0 |
| Dresden | 25.0 | 22.1 | 20.6 | 19.0 | 17.6 | 14.7 | 14.0 | 13.8 | 14.6 | 13.1 | 23.5 | 19.8 | 16.1 | 13.8 | 44.0 |
| Edinburgh | 19.6 | 19.7 | 19.7 | 19.0 | 17.3 | 15.3 | 15.3 | 14.0 | 16.0 | 15.7 | 19.6 | 18.3 | 16.3 | 15.8 | 19.0 |
| Glasgow | 20.6 | 23.1 | 22.8 | 21.2 | 19.5 | 17.3 | 17.5 | 15.1 | 17.7 | 17.6 | 21.8 | 22.0 | 18.4 | 17.6 | 14.0 |
| Hamburg | 25.2 | 25.3 | 24.2 | 17.3 | 16.3 | 14.8 | 14.6 | 14.2 | 14.7 | 13.6 | 25.2 | 25.7 | 15.5 | 14.1 | 44.0 |
| London | 20.9 | 19.7 | 19.8 | 18.5 | 16.1 | 14.0 | 14.0 | 12.7 | 15.0 | 13.6 | 20.3 | 19.1 | 15.0 | 14.3 | 31.0 |
| Melbourne | 20.1 | 21.0 | 16.7 | 15.5 | 14.0 | 13.1 | 12.5 | 12.7 | 12.8 | 14.0 | 20.5 | 18.1 | 13.5 | 13.4 | 33.0 |
| Milan | 30.3 | 30.4 | 27.4 | 23.2 | 22.1 | 19.3 | 20.3 | 17.1 | 20.1 | 15.8 | 30.3 | 25.3 | 20.7 | 17.9 | 40.0 |
| Moscow | 33.3 | 33.6 | 29.2 | 28.7 | 26.6 | 27.6 | 29.6 | 26.9 | 27.2 | 24.3 | 33.4 | 28.9 | 22.1 | 25.7 | 22.0 |
| Munich | 30.4 | 28.3 | 25.8 | 23.9 | 21.0 | 17.4 | 17.6 | 15.9 | 15.8 | 14.7 | 29.8 | 24.8 | 19.2 | 15.2 | 50.0 |
| Paris | 24.4 | 23.0 | 21.2 | 19.2 | 18.0 | 17.5 | 17.4 | 16.7 | 17.2 | 16.3 | 23.7 | 20.2 | 17.2 | 16.7 | 33.0 |
| Petrograd | 32.8 | 26.8 | 25.3 | 24.6 | 23.5 | 25.5 | 24.6 | 24.1 | 20.8 | 21.9 | 29.8 | 24.9 | 24.5 | 21.3 | 35.0 |
| Prague | 32.7 | 29.6 | 27.1 | 24.3 | 22.6 | 19.3 | 19.1 | 18.4 | 16.3 | 15.8 | 31.1 | 25.7 | 20.9 | 16.0 | 51.0 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rio Janeiro | 30.5 | 33.1 | 38.2 | 29.2 | 27.9 | 23.1 | 19.5 | 20.6 | 20.4 | 21.3 | 31.8 | 33.7 | 25.5 | 20.8 | 31.0 |
| Rotterdam | 24.2 | 22.0 | 20.8 | 18.0 | 15.6 | 13.4 | 12.6 | 12.2 | 12.1 | 11.3 | 23.1 | 19.4 | 14.5 | 11.7 | 51.0 |
| Sydney | 20.8 | 17.9 | 14.3 | 12.1 | 11.5 | 10.5 | 10.3 | 10.4 | 10.9 | 11.4 | 19.3 | 13.2 | 11.0 | 11.1 | 46.0 |
| Stockholm | 24.3 | 21.2 | 20.0 | 18.2 | 16.1 | 14.5 | 14.3 | 14.6 | 12.7 | 14.2 | 22.7 | 19.1 | 15.3 | 13.4 | 44.0 |
| The Hague | 23.3 | 20.8 | 18.7 | 16.2 | 14.4 | 13.2 | 12.7 | 12.5 | 12.7 | 10.9 | 22.0 | 17.9 | 13.8 | 11.8 | 49.0 |
| Trieste | 31.1 | 30.4 | 29.8 | 27.5 | 26.3 | 24.5 | 24.6 | 22.9 | 24.0 | 21.1 | 30.7 | 23.6 | 25.4 | 22.5 | 28.0 |
| Turin | 27.2 | 23.5 | 21.6 | 19.8 | 19.6 | 17.5 | 15.4 | 14.9 | 14.2 | 12.9 | 20.3 | 20.7 | 18.5 | 13.5 | 50.0 |
| Venice | 28.3 | 28.0 | 25.1 | 22.8 | 22.2 | 22.2 | 22.1 | 19.0 | 22.8 | 20.9 | 23.1 | 23.9 | 22.2 | 21.8 | 23.0 |
| Vienna | 28.2 | 25.1 | 24.1 | 21.1 | 19.1 | 17.0 | 16.8 | 15.8 | 16.4 | 15.4 | 26.6 | 22.6 | 18.0 | 15.9 | 43.0 |
| Boston | 24.9 | 23.5 | 23.6 | 20.9 | 18.8 | 17.9 | 17.7 | 17.2 | 17.1 | 16.4 | 24.2 | 22.2 | 18.3 | 16.7 | 32.0 |
| Chicago | 21.5 | 19.5 | 20.6 | 15.2 | 14.2 | 14.5 | 14.1 | 15.1 | 14.5 | 14.8 | 20.5 | 17.9 | 14.3 | 14.6 | 32.0 |
| New York | 27.5 | 25.8 | 24.6 | 20.3 | 18.9 | 17.0 | 16.2 | 16.0 | 15.2 | 14.5 | 26.6 | 22.4 | 17.3 | 14.8 | 47.0 |
| Philadelphia | 22.3 | 20.6 | 21.1 | 19.2 | 18.1 | 17.7 | 15.9 | 16.8 | 16.6 | 15.3 | 21.9 | 20.1 | 17.9 | 15.9 | 28.0 |
| Averages | 25.9 | 24.5 | 22.7 | 20.4 | 18.8 | 17.3 | 16.8 | 16.2 | 16.5 | 15.7 | 24.8 | 21.1 | 17.8 | 15.9 | 37.0 |

*Health Department appropriations of cities by size groups**

| POPULATION | CITIES REPORTING | AGGREGATE POPULATION | AVERAGE POPULATION | ANNUAL APPROPRIATION PER CAPITA |
|---|---|---|---|---|
| | | | | *cents* |
| 300,000 and over | 17 | 16,087,038 | 946,296 | 40.3 |
| 100,000 to 300,000 | 38 | 6,045,943 | 159,104 | 27.9 |
| 50,000 to 100,000 | 55 | 3,890,259 | 70,732 | 20.3 |
| 25,000 to 50,000 | 96 | 3,465,081 | 36,095 | 19.8 |
| All cities.................. | 206 | 29,488,321 | 143,147 | 32.7 |

* Compiled from "A survey of the activities of municipal health departments in the United States" by Franz Schneider, Jr., of the Russell Sage Foundation. *American Journal of Public Health,* January, 1916.

These very things make it difficult for the heads of health departments to obtain appropriations of sufficient size. Practically their only statistical argument may be based on the records in their own cities for several years back. If street cleaning, garbage collection, disposal of dead animals and night soil are not done with dispatch the citizens are sure to raise an outcry, and if these duties happen to come within the scope of the health department the director has a chance to air his grief over small appropriations. But with respect to the work of the important division of preventive medicine in the health department, under which may be listed efforts looking to the conservation of the purity of food and drink, tuberculosis work, tenement house and factory inspection, laboratory and dispensary service, and inspection of school children, the results are not capable of noisy exploitation; indeed it is sometimes difficult to show improvement, for it requires years of hard work, with never a lessening of energy, to effect lasting good, and consequently the attendant difficulty in obtaining money to carry on the work is apparent.

It cannot be denied, in the face of indisputable statistical facts, that public health service has raised the health tone of the world in a very material measure, and at this point it may be well to present certain statistics in support of this assertion.

The data contained in Table 2 show that some force, or set of forces combined, was responsible for the marked decrease in the death rate in these thirty-three large world cities, having a combined population of 40,000,000. As compared with thirty years ago the average general death rate in these cities has decreased 37 per cent, which is actually to say that of each 100,000 population 1000 less people die each year than formerly. Based upon present day populations this means that if the old health conditions had obtained in 1912 in these cities totalling 40,000,000 people, a total of 1,036,000 would have died annually, instead of 628,000, as was actually the case. One in sixty-three died in the year 1912 as against one in thirty-nine thirty years previously.

## HEALTH REGULATIONS AND THEIR ENFORCEMENT

In some states there is a wide array of public health laws, some obtuse in their wording, some apparently impossible of execution, but in the best cases the subject is well covered on the whole, and the laws fully ample if they could but be enforced. In other states there is little or no health law or order, and particularly is this noticeable in the southern states.

The government receives and compiles mortality statistics from certain states in the Union, termed "Registration States." The distinction between a registration and a non-registration state is that in the latter vital statistics either are not kept at all, or are so incomplete or inaccurate as to fall under the ban of the Government statisticians. At the close of 1913 the following classification obtained:

*Registration states.* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, Ohio, Kentucky, Indiana, Michigan, Wisconsin, Minnesota, Missouri, Montana, Colorado, Utah, California, Washington and the District of Columbia.

*Non-Registration states.* West Virginia, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Illinois, Iowa, Arkansas, Louisiana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Arizona, Wyoming, Idaho, Nevada and Oregon.

Included in the above list of non-registration states are the populous states of Alabama, Arkansas, Georgia, Illinois, Iowa, Kansas, Louisiana, Mississippi, Nebraska, Oklahoma, South Carolina, Tennessee and West Virginia, which, in themselves, constitute 30 per cent of the total population of the United States. To draw a stricter line of distinction, however, let it be stated that in all the non-registration states in 1913 there were forty-one registration cities with a total population of about 5,200,000. This left a total of about 25,000,000, or about 26 per cent of the total population of the country, where the records of death are so poorly kept, if kept at all, that they were considered unworthy of recognition by the United States government.

Vital statistics serve as a barometer by which the health of the nation may be determined. In this great country one quarter of the people are without such information. If the healthfulness of a people governs the productive power thereof, as it surely does, the lack of reliable statistics from these twenty-five millions of people is mighty poor state and municipal bookkeeping. People are always very particular in demanding a record of real money expenditures, but the ever prevailing list of preventable deaths is one of the greatest leaks in the reservoir of productiveness, and among a quarter of the people of this country no reliable measurement of this leak is made.

TABLE 3

*Growth of the area of registration for deaths*

| YEAR | TOTAL POPULATION UNITED STATES* | REGISTRATION AREA | | | |
|---|---|---|---|---|---|
| | | Population | | Land Area | |
| | | Number | Per cent of total | Square miles | Per cent of total |
| 1880 | 50,156,000 | 8,538,000 | 17.0 | 16,480 | 0.6 |
| 1890 | 62,622,000 | 19,659,000 | 31.4 | 90,700 | 3.0 |
| 1900 | 75,995,000 | 29,800,000 | 39.2 | 194,200 | 6.5 |
| 1905 | 84,219,000 | 34,052,000 | 40.4 | 212,700 | 7.2 |
| 1906 | 85,837,000 | 41,983,000 | 48.9 | 603,100 | 20.3 |
| 1907 | 87,455,000 | 43,017,000 | 49.2 | 603,200 | 20.3 |
| 1908 | 89,073,000 | 46,790,000 | 52.5 | 725,100 | 24.4 |
| 1909 | 90,691,000 | 50,871,000 | 56.1 | 765,700 | 25.7 |
| 1910 | 92,309,000 | 53,844,000 | 58.3 | 998,000 | 33.6 |
| 1911 | 93,927,000 | 59,276,000 | 63.1 | 1,106,700 | 37.2 |
| 1912 | 95,545,000 | 60,427,000 | 63.2 | 1,106,800 | 37.2 |
| 1913 | 97,163,000 | 63,299,000 | 65.1 | 1,147,000 | 38.6 |

* Land area 2,974,000 square miles.

A community may start out with the best intentions. Legislative enactments are put through to protect the public health.

This is simple, for none but the framers of health laws really know what they signify, hence there arises no antagonism to their enactment. Next comes the task of obtaining the necessary funds to enforce these laws. The average appropriation of all the cities where such funds are made avaliable is in round numbers 30 cents per capita per annum. This applies only to those cities having populations of 25,000 or more. What of the remainder?

Let any thinking citizen ask himself if he considers a contribution of 30 cents each year on his part sufficient justification for his assurance of protection against preventable disease. Or, as another example, if he thinks, if given in charity, it is his proper share toward the fund for keeping in check and preventing the spread of the great white plague, which kills 130,000 people in America each year. Unquestioningly he would give far more to street beggars in the course of a year. If every man, woman and child in the United States contributed one dollar each year to public health work, the total sum thus raised would not nearly equal the annual loss in vital capital in this country from typhoid fever alone. Not one city in America does contribute one dollar per capita for all the uses of its health department, but on an average contributes the farfamed thirty cents, which is opprobrium enough.

In the states best off with respect to health laws recorded on their statute books, the proper enforcement of these laws is never carried out. Observe the anti-spitting law enacted only a few years ago. No law was more proper, but in the beginning, when an arrest for its violation was made, it was so unusual a proceeding that the ensuing brief court proceedings were likely to find their way to the front page of the newspapers, and for days thereafter the cartoonists were busy with their humorous pencils creating and nursing a spirit of mockery so often fatal to the public good. The law prevailed, nevertheless, more through the effects of ingenious placarding of the statute than a fear of legal apprehension, or an honest belief that disease was spread in this manner.

Laws looking to the prevention of contamination of food and drink commonly are allowed to lie peacefully within the covers of the books of law, seldom to be disturbed. The screening law, calling for the protection of foods exposed for sale from the explorative activities of the deadly house fly, was observed where there was no apparent way out of it, but the screens, when provided, were often improperly constructed, and since they were more or less of a nuisance to the owner in disbursing his wares, were never more than partly effective.

In fact, as with the majority of all health laws, the collective public affected thereby observes them with reluctance, protestingly, and without sincerity. If all the good health laws, laws which actually should be observed, were rigidly enforced, there would not be enough jail room in any city to accommodate the violators thereof, nor court officials enough to try the cases.

All public health laws have a penalty attached for violation. commonly it takes the form of a ridiculous fine or term of imprisonment. The arms of the law hesitate to make arrests, and the court usually limits the penalty to a reprimand, not infrequently administered to the officer making the arrest. Both fear an outburst of indignation accompanied by claims of discrimination and persecution, the officer from the court, and the court from the public, since the general violation of such laws by the public is so common.

It may be an oldfashioned idea, but it would be supposed that laws are framed and enacted for some good purpose, and that they are expected to be enforced, but if even such laws as now stand on the statute books were rigidly enforced the introduction of a sea of amendments would immediately follow, and in the meantime many new faces would appear in the health, police and judiciary departments. The American public, in this day and generation, will not tamely submit to being forced to do without anything in the form of a privilege to which it has become accustomed.

A community blessed with reasoning power impelling sensible appropriations for public health work, adequate laws and officials courageous enough to enforce them, has progressed far in the direction of Utopianism. Cleanliness is indeed next to godliness, but so imperfectly is its meaning understood that a fair bulk of the country's population think it means merely a good cleanup on Saturday night, and keeping one's thumb out of the other fellow's soup.

## CAMPAIGNS FOR PURE WATER SUPPLIES

No one can gainsay that in progressive states the majority of the movements looking to the improvement of public water supplies originate in the health department. Especially is this true where the community is small, and where the water department officials do not feel warranted in employing relatively expensive men who are technically trained in water analysis and matters in general relating to water pollution. Then, too, the officials of large cities often are slow to act in such matters, and too prone to fall back upon arguments based on the financial inability of the community to carry through the construction of water purification works. It can be stated unqualifiedly that no community, whatever its size, is too poor to have a pure water supply. It is better to have bad streets, grade crossings, and inadequate public buildings, than to tolerate a public water supply of questionable purity.

Grade crossings are a menace to life, to be sure, but not nearly as great a menace as a bad water supply; and they are more often abolished for the sake of convenience than as a measure of public safety. Good streets promote business and the public comfort, but such improvements do not measure up on a level of importance with a supply of pure water. Attractive, roomy and light public buildings are a matter of common civic pride, but it is doubtful if they tend materially to increase the efficiency of those who labor therein.

Of all public works the water works is by far the most important, and should always be given preference in the allotment of moneys for the city's maintenance. Ever since it became known that bad water was dangerous to health the public has been entitled by sovereign right to receive pure water. Bad water will put out conflagrations as promptly as pure water, but it also will cause widespread disease, which is more important. In the last thirty-odd years the loss in vital capital through typhoid fever alone was over three times the net property loss from fire in the United States.

It is the customary design that the water works department of a community shall be self supporting, but it is rare that large sums of money are kept on hand to defray extraordinary expenses in the department. When questions arise as to the adequateness of the supply as regards volume, or more satisfactory distribution, little difficulty is experienced in obtaining the necessary funds to carry out the work, for the comfort and convenience of the public are affected. With improvements in the supply respecting purification it is different. When a city of a hundred thousand people is confronted with evidence furnished by its own officials and those of the state health department showing that the water supply requires purification, and learns that works to effect this end will cost, say, $300,000, there follows an energetic sharpening of pencils to ascertain how this is going to affect the tax rate. There is strong opposition to the movement from the very beginning.

The state health officials, realizing the necessity better than anyone else, order that purification works be built. The cost thereof being estimated, the matter of a bond issue to carry the expense is put up to the people, and very often is defeated. Then an extension of time is allowed, and the matter drifts along for years without any definite advance.

Many cities have endured an excessively high typhoid fever death rate for years, and withheld the financial support necessary for the furtherance of measures of prevention, even when it was plain that the public health of the community would be immensely benefited thereby. Great cities, such as Baltimore, Cincinnati, Louisville, Minneapolis, Philadelphia, Pittsburgh, St. Louis and Washington, temporized with the matter for years before building purification works, and in the meantime thousands of their citizens were needlessly killed by waterborne diseases. Then they built filter plants, and it is safe to say that if a candidate for public office in any of these cities should advocate the abandonment of filtration, he would stand as much chance of election as the proverbial snowball has of existence in Gehenna. The people in these cities now realize what pure water means to them, and while at first reluctant to believe, actual experience of the benefits has turned their minds just as far, or farther, in the opposite direction.

Laws have been enacted giving to the state the power to force the purification of public water supplies within their boundaries. The socalled Bense Act of Ohio is one of these. There is need of more legislation of this kind, which leads to the protection of the public against itself. Such power, placed in competent hands, and with sufficient funds to enforce it, cannot but do immeasurable good. Too much reliance is put in moral suasion in such matters nowadays. The money can always be found if it has to be found, and many a man has put off the urgently necessary visit to the dentist because of the physical pain incident to such a visit, and the strain on his pocketbook; but he is always happy and satisfied when it is all over.

It is precisely so with forced expenditures of public money for water purification. The thinking citizen realizes that he is taking a chance with disease every time he drinks a glass of contaminated city water, and yet is ready with excuses, chiefly of a financial nature, for not helping along the campaign for pure water; but no matter what he finally is compelled to pay for it, when he realizes how he has been benefited he is perfectly satisfied, even though for a time he is obliged to go without new paving in front of his house, apologize to visitors for his antiquated city hall, or something of the sort.

## STATE BOARD OF HEALTH APPROVAL OF WATER IMPROVEMENT PROJECTS

It is probable that about twenty-five years ago the health departments in different states began to realize the importance of some sort of control over the water supplies of communities located within their borders. Twenty years ago the legislative acts, under which some of these boards operated, required that plans for new water works installations be filed with them. At that time, however, they had little or no authority to take action on such plans. The powers vested in them since then, however, have been increased, until at the present time, practically without notable exception, all state health departments may, at discretion, reject plans for new installations or improvements in water works in general, including water purification works. It is very questionable whether the efficiency of the health departments, as to the specific qualifications of its officials, has kept pace with the increased power given them.

When a city has decided to install a water purification plant, plans and specifications thereof formally are presented to the state health department, for under the law in many states such plans and specifications must be approved by that department before construction work can proceed. This should be a most desirable procedure, for it guards against the construction of plants unsuited to the local conditions, and it should lend to a community a feeling of confident security.

Where the health officials, who thus hold an arbitrary position, are qualified by experience and ability to pass on such matters, and where they are fair minded into the bargain, the plan works out to the advantage of all. If they are not competent, however, their actions retard progress, and may be such as to prevent the installation of an entirely suitable, well designed, adequate work, or permit the installation of a plant which is entirely unsuitable, actually dangerous, and a menace to the health of the community.

Some states are blessed with the good fortune of having health departments the personnel of which is of high standard, and consequently the results accomplished are worthy of far greater public recognition than they usually receive. Other states are less fortunate. These also should receive the careful consideration of the public, to the end that they be brought up to a standard of real usefulness.

The author believes that an important and controlling amendment to all existing public health laws should be made, particularly those surrounding the contemplated purification of public water supplies. To promote the health and comfort of such a community the law should require that the water as delivered to the consumer comply at all times with reasonable standards of purity, essentially as regards its bacterial content and physical characteristics. Furthermore, that any method of purification, tangibly guaranteed continuously to furnish a water at all times complying with the law, shall be acceptable. The physical features of such purification plants thus would not be subject to approval by the health department, it being the duty of that department, as is eminently proper, to see to it that the guarantees under which the plant was constructed are fully complied with.

Most public health laws governing water purification projects specify that plans and specifications of the contemplated works shall be submitted to the health department, and that construction work shall not be begun until the health department has indicated its approval thereof. No time limit is set for such action by the health department, and this is needed to preclude unnecessary inaction, provided the law delegating to the health department the power to approve or reject a project on the plans and specifications is allowed to stand. As these laws now read the approval of such projects may, for one reason or another, be delayed indefinitely and to enforce action mandamus proceedings provide the only way out of the difficulty. There are cases on record where water purification projects have been held up for many months, and even killed, by the prejudicial attitude of the health department toward the rapid sand process of filtration. The improper use of power in this manner is clearly against the interests of the state, and its further exercise should be prevented by legislative action.

## TYPHOID FEVER IN THE UNITED STATES

In the following tables there is given a fairly complete survey of the death toll from typhoid fever in the United States. Exceptional accuracy is not claimed for these statistics, for the reason that the data were of necessity compiled from United States Census, state and municipal reports, which in many cases agree only approximately. In some places mortality statistics have been kept but a relatively short time, and frequently there is marked conflict between local reports and the summaries of the United States government. In the appendix a number of tables of detailed data will be found.

## TOTAL AND TYPHOID FEVER DEATH RATES IN THE REGISTRATION STATES

In Table 4 and Plate 1 a comparison is made of the deaths from all causes and from typhoid fever, respectively, in the registration states for the years 1910–1913, inclusive. The data have been arranged so as to show the relative mortality in urban and rural districts.

The mortality census of something over one half of the total population of the United States is thus presented. In brief the data show

TABLE 4

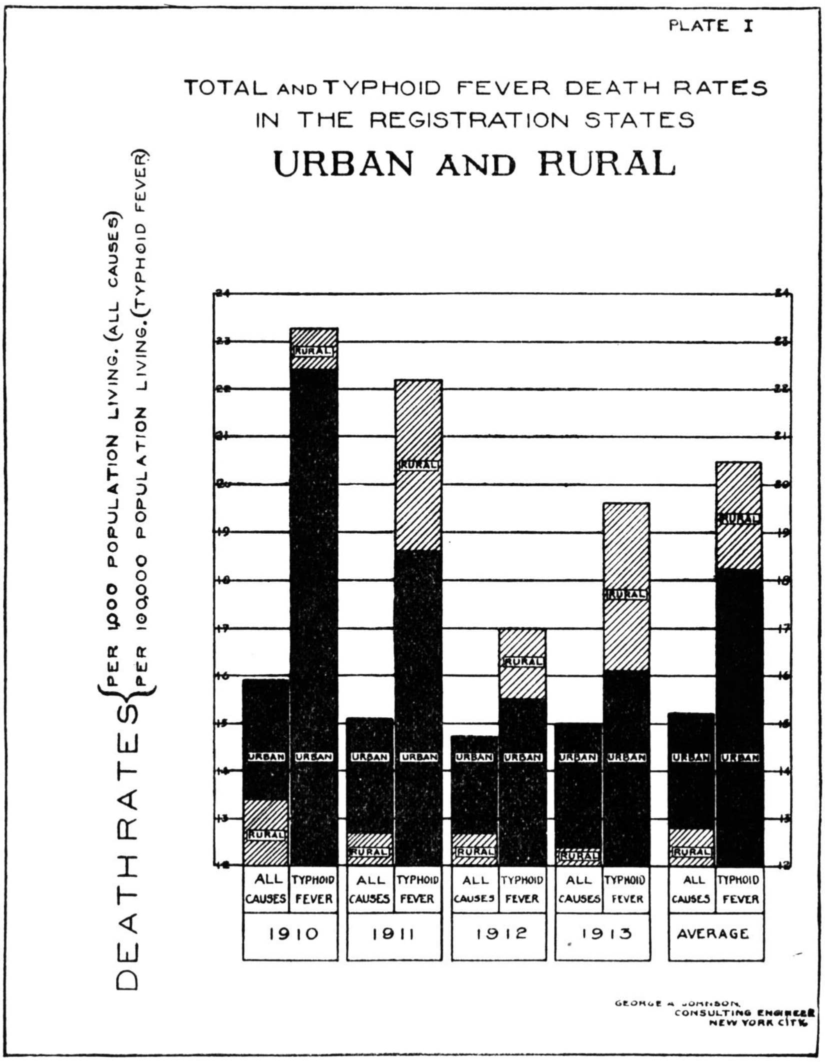
*Total and typhoid fever death rates in the registration states. Urban and rural*

| YEAR | | 1910 | 1911 | 1912 | 1913 | AVERAGE |
|---|---|---|---|---|---|---|
| Population | Urban...... | 25,047,000 | 27,303,000 | 28,130,000 | 29,244,000 | 27,431,000 |
| | Rural....... | 22,563,000 | 25,942,000 | 27,122,000 | 29,069,000 | 26,174,000 |
| | Total....... | 47,610,000 | 53,245,000 | 55,252,000 | 58,313,000 | 53,605,000 |
| | Per cent, registration states of total United States.... | 51.5 | 56.7 | 57.8 | 60.0 | 56.6 |
| Rates, all causes* | Urban...... | 15.9 | 15.1 | 14.7 | 15.0 | 15.2 |
| | Rural....... | 13.4 | 12.7 | 12.7 | 12.4 | 12.8 |
| | Total....... | 14.7 | 13.9 | 13.6 | 13.9 | 14.0 |
| Rates typhoid fever† | Urban...... | 22.4 | 18.6 | 15.5 | 16.1 | 18.2 |
| | Rural....... | 23.3 | 22.2 | 17.0 | 19.6 | 20.5 |
| | Total....... | 22.8 | 20.4 | 16.2 | 17.8 | 19.3 |

* Per 1000 population living.

† Per 100,000 population living.

a small but gradual decrease in the general death rate during the four years in question, that for 1913 being about 5.5 per cent lower than the rate for 1910. The reduction in the typhoid fever death rate during the same period was more marked, the rate for 1913 being some 22 per cent lower than that for 1910.



The data also show that the death rate from all causes in the rural districts is consistently lower than that of urban districts, and is decreasing more rapidly; while, contrariwise, the typhoid fever death rate is lower in the urban districts and is decreasing more rapidly than in the rural districts.

This is in some respects a gratifying, but not unexpected showing. As regards the death rate from all causes, it was to be anticipated that city life would be shown to be generally less healthful than country life. As regards the preventable disease, typhoid fever, the results are just such as might be expected. Sanitation is bound to progress more slowly in the country where education is less of a helpful factor, where the treatment of the patient is often attempted at home with all the attending dangers of secondary infection, and last, but by no means least, where the domestic "sanitary" conveniences are neither convenient nor sanitary, and where the house fly is allowed free rein to exercise his malignant practices. In cities the sanitary conveniences in general are really sanitary, the fly is less of a domestic pet, and a majority of the large cities have pure water supplies. The hospitals are made more use of in the treatment of typhoid cases, and the all around care of the disease is on a much higher plane of efficiency.

Probably the best illustration of the relative prevalence of typhoid fever in urban and rural districts was presented a dozen years ago by Dr. John S. Fulton,[1] and a digest of his data is presented in Table 5. These statistics are of the most convincing character.

TABLE 5

*Relative prevalence of typhoid fever in urban and rural districts*

| NUMBER OF STATES | PER CENT WHICH THE URBAN POPULATION WAS OF THE TOTAL POPULATION | AVERAGE PER CENT OF RURAL POPULATION | AVERAGE TYPHOID FEVER DEATH RATE PER 100,000 POPULATION |
|---|---|---|---|
| 5 | Over 60 | 30 | 25 |
| 6 | 40 to 60 | 49 | 42 |
| 7 | 30 to 40 | 67 | 38 |
| 8 | 20 to 30 | 75 | 46 |
| 12 | 10 to 20 | 87 | 62 |
| 12 | 0 to 10 | 95 | 67 |

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[1] Annual Report of the State Board of Health of Maryland for 1903.

## SEASONAL DISTRIBUTION OF TYPHOID FEVER

Typhoid fever is essentially a disease of the summer and autumn. In the broad analysis of the mortality statistics, whether from rural or urban districts, just so sure as June comes around it is equally certain that an increase in the typhoid fever death rate will occur, but this increase is far greater in the country than in the city.

In this connection it is to be borne in mind that the data herein discussed, for the most part, do not include statistics from southern countries where the winters are warmer. The sole reason why such statistics are not used is that there are no such figures available.

TABLE 6

*Typhoid fever death rates in the registration states, seasonal distribution*

| MONTH | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION LIVING | | | | |
|---|---|---|---|---|---|
| | 1910 | 1911 | 1912 | 1913 | Average 1910–1913 |
| January | 15.7 | 16.8 | 15.1 | 10.8 | 14.6 |
| February | 14.5 | 15.4 | 12.0 | 9.6 | 12.9 |
| March | 16.3 | 14.6 | 13.0 | 9.7 | 13.4 |
| April | 14.3 | 13.2 | 11.5 | 9.0 | 12.0 |
| May | 12.1 | 12.5 | 11.4 | 11.0 | 11.8 |
| June | 13.1 | 14.7 | 10.8 | 12.1 | 12.7 |
| July | 16.7 | 17.5 | 14.4 | 19.7 | 17.1 |
| August | 30.8 | 30.7 | 20.8 | 27.8 | 27.5 |
| September | 41.8 | 30.7 | 25.0 | 29.1 | 31.6 |
| October | 42.5 | 33.4 | 25.9 | 29.2 | 32.8 |
| November | 34.3 | 27.4 | 19.1 | 21.0 | 25.5 |
| December | 23.0 | 18.5 | 16.1 | 15.8 | 18.4 |
| Averages | 22.9 | 20.8 | 16.2 | 17.1 | 19.2 |

| Estimated total population | |
|---|---|
| | 1910, 47,610,000. |
| | 1911, 53,245,000. |
| | 1912, 55,252,000. |
| | 1913, 60,980,000. |

Rural population of the registration states about 48 per cent of the total

These data show that every year, just previous to the advent of summer, the typhoid fever death rate is at its lowest mark. In June the beginning of the annual rise is first noted, and the rate increases from then on until the autumn, when the decrease begins, the rate reducing gradually through the winter months.

What forces are operative to bring about this persistent phenomenon? Why is typhoid more prevalent in the warm months of the year? Why does not the disease drop off abruptly with the advent of cold weather, instead of gradually, and only reaching its lowest ebb at the close of winter and the advent of spring?

There is nothing in an argument that the general health tone of the public at large is highest in the warm months of the year. The records from 60,000,000 people in this country show that during the six months, May to October, inclusive, 48.5 per cent of the annual deaths occur, as against 51.5 per cent for the six-month period, November to April, inclusive.

TABLE 7

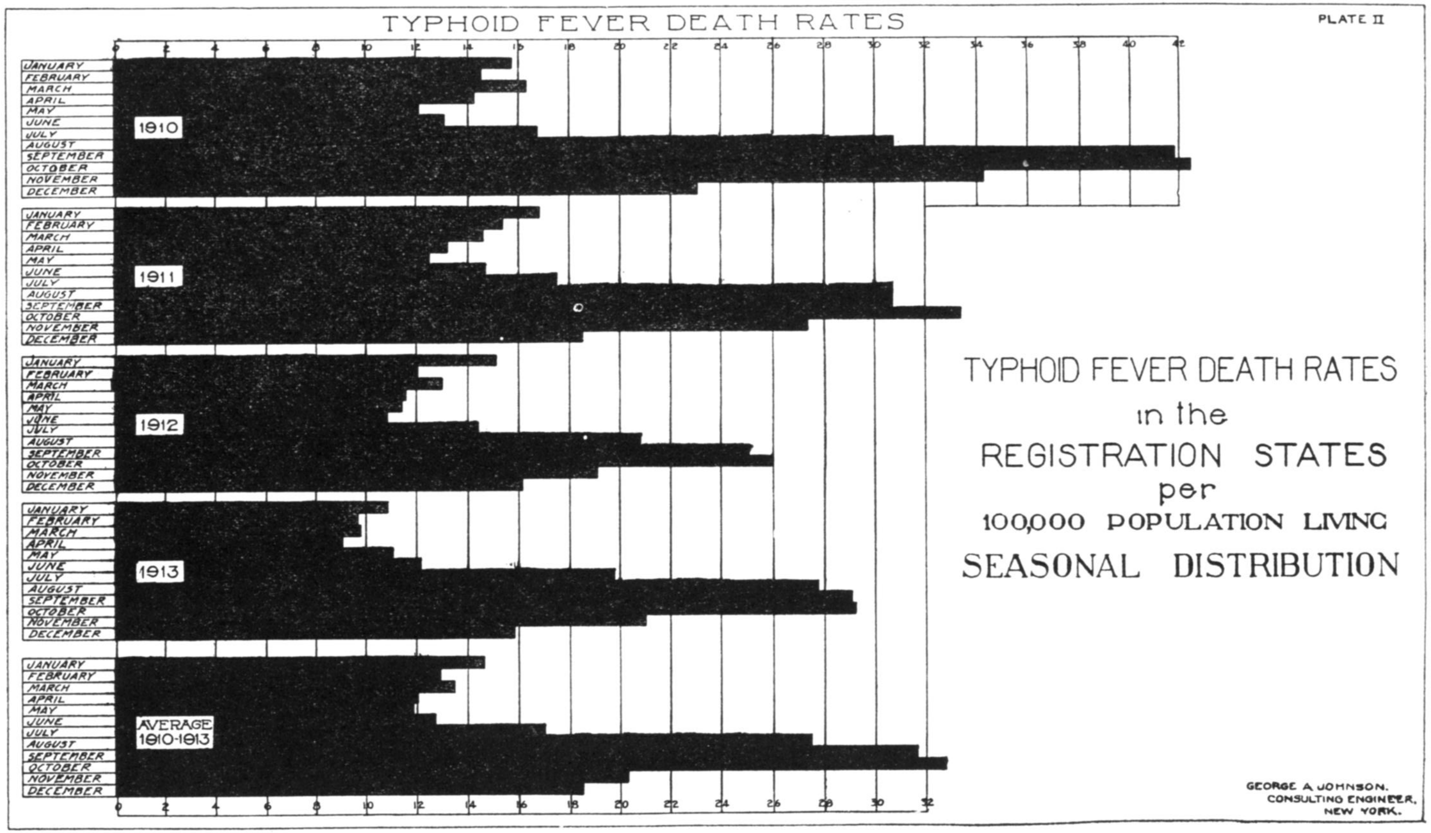
*Typhoid fever death rates in large American cities, seasonal distribution*

| MONTH | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION LIVING | | | | |
|---|---|---|---|---|---|
| | 1910 | 1911 | 1912 | 1913 | Average 1910–1913 |
| January | 15.0 | 11.4 | 13.2 | 7.5 | 11.8 |
| February | 14.8 | 9.4 | 8.3 | 7.7 | 10.0 |
| March | 16.4 | 10.0 | 7.1 | 7.5 | 10.5 |
| April | 12.8 | 8.4 | 8.8 | 7.2 | 9.3 |
| May | 11.7 | 9.7 | 7.3 | 9.8 | 9.9 |
| June | 12.4 | 11.0 | 9.4 | 9.8 | 10.4 |
| July | 13.9 | 15.1 | 11.8 | 13.4 | 13.5 |
| August | 22.5 | 22.1 | 17.8 | 17.4 | 19.9 |
| September | 29.3 | 22.0 | 17.2 | 19.2 | 21.9 |
| October | 25.2 | 18.2 | 15.3 | 22.1 | 20.2 |
| November | 22.6 | 18.7 | 10.5 | 16.4 | 17.5 |
| December | 16.6 | 13.6 | 10.0 | 11.9 | 13.0 |
| Averages | 17.7 | 14.1 | 11.4 | 12.1 | 13.9 |

Estimated total population
1910, 15,463,000.
1911, 15,968,000.
1912, 16,306,000.
1913, 16,708,000.

In the warm months the public feeds more largely on uncooked green fruits and vegetables, and considering impure foods as media for typhoid infection, green fruits and vegetables consumed uncooked unquestionably are the most liable to dangerous contamination through the agency of flies, and handling by persons whose fingers are soiled with typhoid infected excreta.

PLATE II


TYPHOID FEVER DEATH RATES
0
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4
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40
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JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
1910
1911
1912
1913
AVERAGE 1910-1913
TYPHOID FEVER DEATH RATES
in the
REGISTRATION STATES
per
100,000 POPULATION LIVING
SEASONAL DISTRIBUTION
GEORGE A. JOHNSON.
CONSULTING ENGINEER,
NEW YORK.

In the winter the watersheds of streams and lakes are often frozen up, and the streams draining them also are frequently frozen over, and for these two reasons public water supplies receive less polluting matter from the rural districts and semiurban districts where the selfemptying privy is still used. Alternate freezing and thawing also tends to kill the typhoid germ more quickly. With the advent of warmer weather thaws occur, and the winter accumulations of filth are washed from the catchment areas into the streams and lakes. Stream pollution is thus made doubly dangerous because of the sudden addition of the winter accumulations. Communities which do not purify their public water supplies thus suffer from an increase in typhoid fever with the advent of warm weather.

Throughout the summer the contributions of sewage from the watershed continue without cessation, being aggravated occasionally by heavy rains which flush off the catchment area and badly soil the rivers and lakes which drain it. The brooks and rivers are no longer frozen over even a part of the time. They promptly get all the filth the watershed can contribute. Without an efficient purification plant in the water works system, the communities using such surface waters must expect to pay, and do pay, a corresponding toll to typhoid fever in consequence of their neglect.

The house fly begins to get in its underfoot work as soon as the warm weather appears. It is midsummer, however, before he fully gets into his stride. All the time typhoid fever has been gradually increasing, and reaches its apex in the early autumn. The fly, also, begins to disappear about this time, and is observed to go about its self imposed duties of carrying typhoid germs to the table from the privy and elsewhere with greater reluctance and less dispatch.

With the advent of winter the typhoid rate begins to fall off, but not rapidly. Dry weather obtains and less polluting matter enters the streams. The activities of the house fly diminish rapidly. But the typhoid patients of the summer and autumn furnish the seed for the crop of winter typhoid through the important medium of secondary infection, and the typhoid death rate gradually falls off as the number of new cases decreases. And thus the annual cycle is completed, a new one to be begun the following summer.

### SEASONAL DISTRIBUTION OF RURAL AND URBAN TYPHOID

Referring back to Tables 6 and 7 and Plate II, it is instructive to compare the seasonal distribution of typhoid fever in the registration states, which includes statistics for both the rural and urban population, and the same class of data for large cities. It is already understood, of course, that the rural typhoid death rate is higher than the urban, but a point of real significance is lost sight of until the following comparison is made, as shown in Table 8 and Plate III.

TABLE

*Comparison of the combined rural and urban typhoid fever death rate with that in large cities (average for four years 1910–1913)*

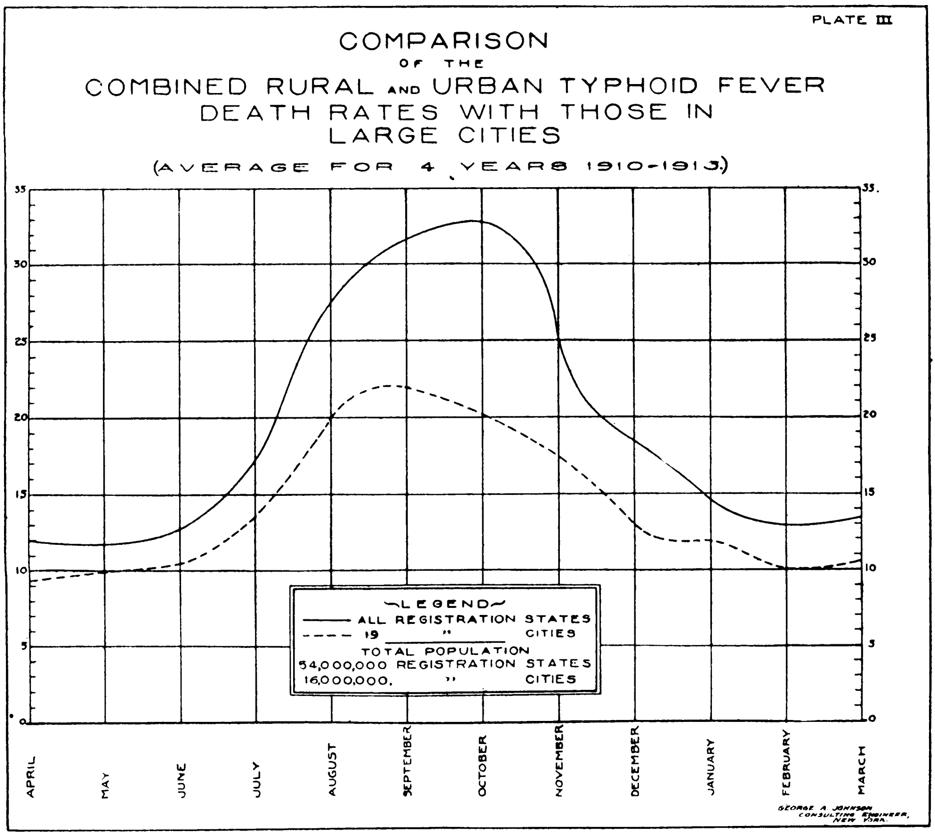
| MONTH | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION | | | EXCESS OF DEATH RATE IN STATES OVER CITIES |
|---|---|---|---|---|
| | Registration States | Registration Cities | Excess of States over Cities | |
| | | | | *per cent* |
| January | 14.6 | 11.8 | 2.8 | 24 |
| February | 12.9 | 10.0 | 2.9 | 29 |
| March | 13.4 | 10.5 | 2.9 | 28 |
| April | 12.0 | 9.3 | 2.7 | 29 |
| May | 11.8 | 9.9 | 1.9 | 19 |
| June | 12.7 | 10.4 | 2.3 | 22 |
| July | 17.1 | 13.5 | 3.6 | 27 |
| August | 27.5 | 19.9 | 7.6 | 38 |
| September | 31.6 | 21.9 | 9.7 | 44 |
| October | 32.8 | 20.2 | 12.6 | 62 |
| November | 25.5 | 17.5 | 8.0 | 46 |
| December | 18.4 | 13.0 | 5.4 | 42 |
| Averages | 19.2 | 13.8 | 5.4 | 39 |

NOTE: Figures for the registration states cover a population of some 54,000,000. The figures for the large American cities were compiled from the statistics of nineteen of the largest American cities, having a total population of 16,000,000. (See Appendix Tables 26 to 30, inclusive.)

The foregoing data are pointedly significant. In the registration states, which include the rural as well as the urban population, the typhoid fever death rate is always higher than that for the cities, averaging 39 per cent higher, in fact, during a total period of four years.

Now the rural population of the registration states amounted to about 26,000,000 out of a total population of 54,000,000. Its effect on the much higher typhoid fever death rates in whole states as compared with cities, is plain. It is instructive to compare these data with those given in Table 5.

The comparison is not so fair of course, as the one made in Table 4, nevertheless it serves to emphasize the point that rural districts are intensified cultures from which a continuous stream of typhoid is fed to the city dweller through the media of polluted water, milk and other dairy products, and green fruits and vegetables.



Observe in Table 8 how much lower is the typhoid increase in the cities as summer approaches, and waxes and wanes into autumn, than in the states as a whole. The endemic typhoid in the latter is always greater than in the cities, and when the warm weather comes typhoid fever holds high carnival in the country. It has fewer agencies to combat it than in the city, and when the peak of the annual typhoid curve is reached in October, the city typhoid fever death rate is less than two-thirds of that of the combined rural and urban population.

### DEATH RATES FROM DISEASES OF THE RESPIRATORY ORGANS

While it may seem somewhat out of place in this paper to discuss specific diseases other than typhoid fever, several facts confronted the author as the statistical data came together which seemed to require explanation. As already pointed out, the general death rate from all causes is more or less of a constant throughout all seasons of the year, while typhoid fever is decidedly a warm weather disease. Likewise, diseases of the respiratory organs are more fatal during the cold months, as would be expected.

TABLE 9

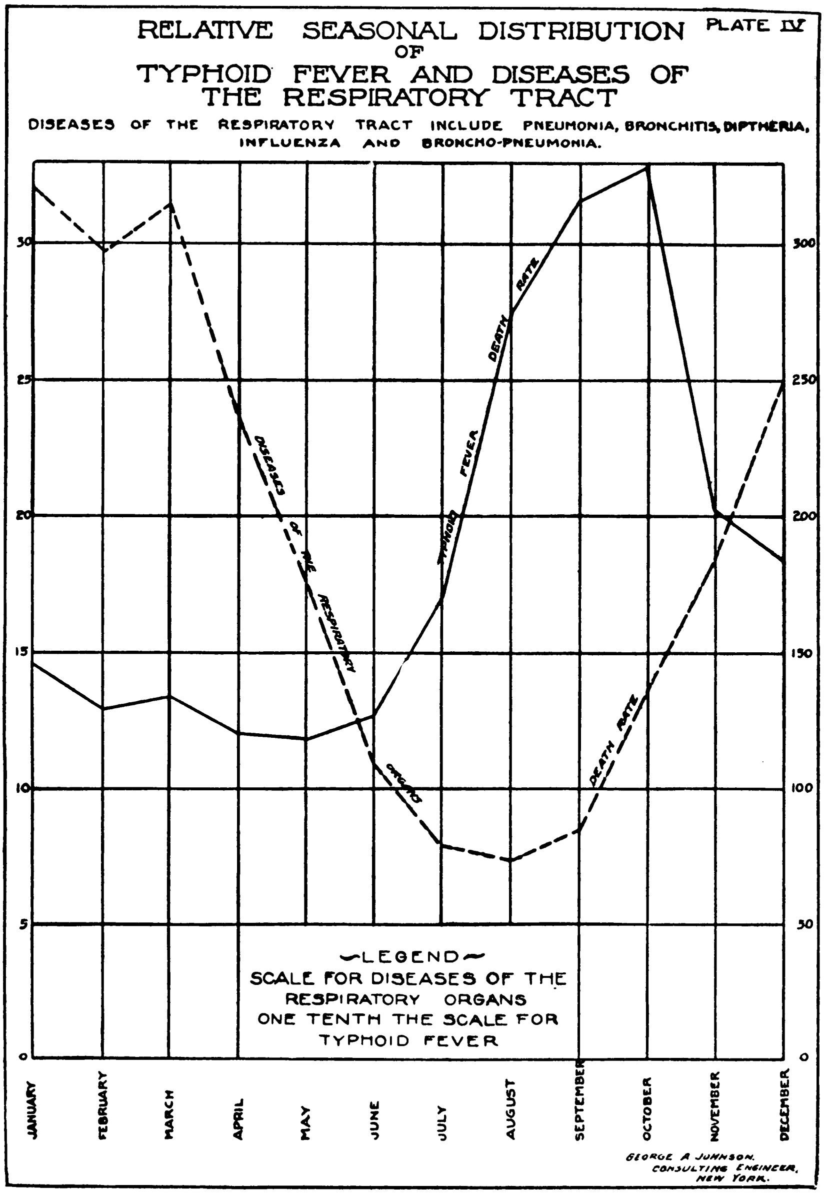
*Death rates of the diseases of the respiratory organs in the registration area, seasonal distribution*

| MONTH | DEATH RATES PER 100,000 POPULATION LIVING | | | | |
|---|---|---|---|---|---|
| | 1910 | 1911 | 1912 | 1913 | Average 1910–1913 |
| January | 313 | 356 | 291 | 324 | 321 |
| February | 289 | 316 | 282 | 303 | 297 |
| March | 341 | 324 | 287 | 310 | 315 |
| April | 260 | 257 | 218 | 211 | 236 |
| May | 206 | 176 | 158 | 162 | 175 |
| June | 132 | 87 | 100 | 115 | 109 |
| July | 90 | 75 | 72 | 77 | 79 |
| August | 82 | 72 | 73 | 71 | 74 |
| September | 98 | 83 | 83 | 77 | 85 |
| October | 145 | 130 | 142 | 122 | 135 |
| November | 216 | 184 | 172 | 166 | 184 |
| December | 304 | 223 | 272 | 205 | 251 |
| Averages | 207 | 188 | 180 | 181 | 189 |

Estimated total population in the registration area (Including registration cities in non-registration States)

1910, 53,843,900
1911, 59,276,000
1912, 60,427,200
1913, 63,298,700

In Table 9 and Plate IV this point is plainly brought out, and it is interesting to note from the diagram the balancing effect of the winter mortality from diseases of the respiratory organs on the warm weather mortality from typhoid fever.



RELATIVE SEASONAL DISTRIBUTION OF TYPHOID FEVER AND DISEASES OF THE RESPIRATORY TRACT

PLATE IV

DISEASES OF THE RESPIRATORY TRACT INCLUDE PNEUMONIA, BRONCHITIS, DIPTHERIA, INFLUENZA AND BRONCHO-PNEUMONIA.

LEGEND

SCALE FOR DISEASES OF THE RESPIRATORY ORGANS ONE TENTH THE SCALE FOR TYPHOID FEVER

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### TABLE 10

*Total deaths from all causes in the registration area and per cent distribution by age*

| AGE | TOTAL DEATHS AVERAGE FOR FOUR YEARS | PER CENT DISTRIBUTION | | | | |
|---|---|---|---|---|---|---|
| | | 1910 | 1911 | 1912 | 1913 | Average for 4 years |
| *years* | | | | | | |
| Under 5 | 214,142 | 27.0 | 25.0 | 24.4 | 25.3 | 25.4 |
| 5 to 9 | 18,386 | 2.2 | 2.2 | 2.6 | 2.2 | 2.4 |
| 10 to 19 | 32,836 | 3.9 | 3.9 | 3.8 | 3.9 | 3.8 |
| 20 to 29 | 65,618 | 7.8 | 7.9 | 7.3 | 7.8 | 7.7 |
| 30 to 39 | 72,634 | 8.5 | 8.8 | 8.5 | 8.4 | 8.5 |
| 40 to 49 | 77,397 | 9.1 | 9.2 | 9.2 | 9.1 | 9.2 |
| 50 to 59 | 89,171 | 10.1 | 10.5 | 10.9 | 10.8 | 10.5 |
| 60 to 69 | 104,400 | 12.0 | 12.3 | 12.7 | 12.4 | 12.4 |
| 70 to 79 | 104,187 | 11.9 | 12.4 | 12.7 | 12.4 | 12.4 |
| 80 and over | 65,277 | 7.5 | 7.8 | 7.9 | 7.9 | 7.7 |
| Totals | 818,448 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

### TABLE 11

*Total typhoid fever deaths in the registration area and per cent distribution by age*

| AGE | TOTAL TYPHOID DEATHS | | | | | PER CENT DISTRIBUTION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1910 | 1911 | 1912 | 1913 | Average for four years | 1910 | 1911 | 1912 | 1913 | Average for four years |
| *years* | | | | | | | | | | |
| Under 5 | 629 | 675 | 536 | 627 | 617 | 5.0 | 5.4 | 5.4 | 5.5 | 5.3 |
| 5 to 9 | 684 | 747 | 643 | 759 | 708 | 5.4 | 6.0 | 6.4 | 6.7 | 6.1 |
| 10 to 19 | 2,534 | 2,551 | 2,017 | 2,369 | 2,368 | 20.0 | 20.4 | 20.2 | 20.9 | 20.4 |
| 20 to 29 | 3,780 | 3,502 | 2,815 | 3,183 | 3,320 | 29.8 | 28.1 | 28.2 | 28.2 | 28.6 |
| 30 to 39 | 2,186 | 2,148 | 1,677 | 1,741 | 1,938 | 17.3 | 17.3 | 16.8 | 15.4 | 16.7 |
| 40 to 49 | 1,341 | 1,245 | 1,036 | 1,230 | 1,213 | 10.6 | 10.0 | 10.4 | 10.8 | 10.4 |
| 50 to 59 | 869 | 829 | 662 | 754 | 778 | 6.9 | 6.8 | 6.6 | 6.6 | 6.7 |
| 60 to 69 | 405 | 486 | 391 | 429 | 428 | 3.2 | 3.9 | 3.9 | 3.8 | 3.7 |
| 70 to 79 | 192 | 203 | 167 | 165 | 182 | 1.5 | 1.6 | 1.7 | 1.5 | 1.6 |
| 80 and over | 53 | 65 | 43 | 66 | 57 | 0.3 | 0.5 | 0.4 | 0.6 | 0.5 |
| Totals | 12,673 | 12,451 | 9,987 | 11,323 | 11,608 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

## MORTALITY FROM ALL CAUSES AND FROM TYPHOID FEVER, ACCORDING TO AGE OF DECEDENT

Infant mortality in America is a subject upon which much is written each year, and while some improvement is noted from year to year the number of children who die before they reach the age of five years is appalling. Of all the deaths at all ages from all causes occurring during the year, one quarter of them are children under five years old. Over 350,000 babies die annually in this country, most of them through ignorance, and private and public neglect, but typhoid fever is not a great contributing factor in this because of the very immaturity of the subject.

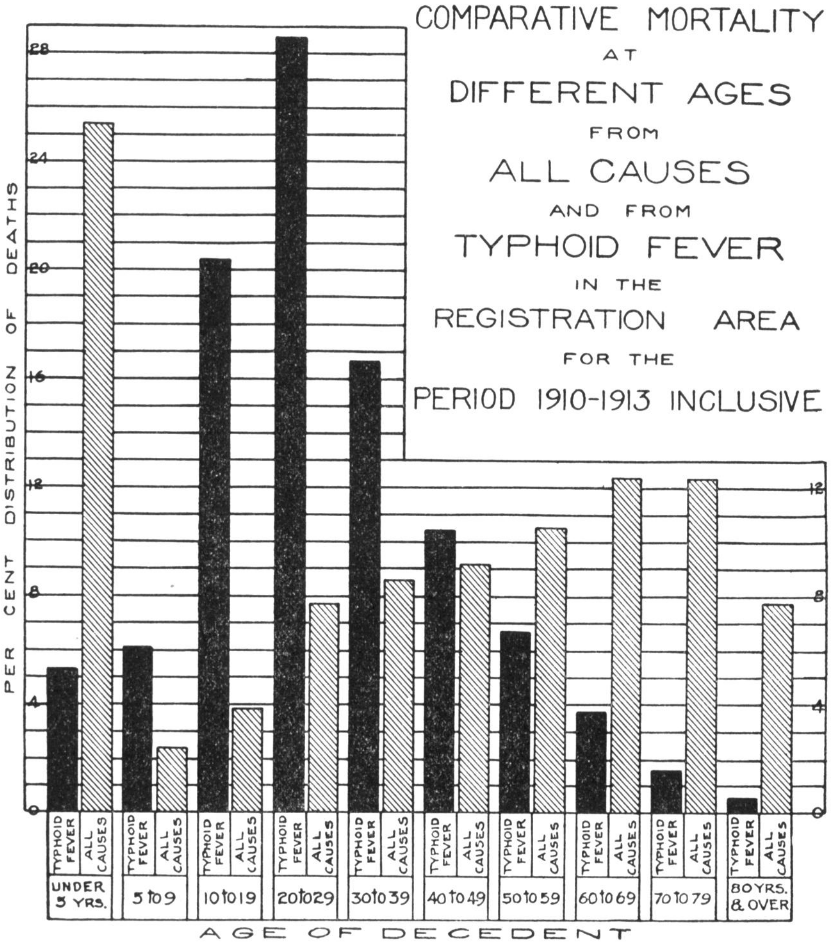
In Tables 10 and 11, and Plate V, the percentage distribution of deaths from all causes and from typhoid fever is shown. After passing the age of five years the percentage of deaths from all causes gradually rises without a break to an apex between the years of sixty and eighty, and then falls off abruptly. In the case of typhoid fever the most dangerous age period is from twenty to thirty years. Until the subject is ten years of age, and after he passes fifty, a relatively high degree of immunity obtains. Over three-quarters of all typhoid deaths occur between the ages of ten and fifty.

## WHITE AND COLORED TYPHOID FEVER DEATH RATES

One-tenth of the population of the United States are colored. A large share of this population resides in the southern states, from which no vital statistics are available. In Table 12 statistics are given for the years 1911, 1912 and 1913 from seven states, having at present a total population around 27,000,000 and a colored population of about 1,800,000. These data are arranged to show the relative typhoid fever death rates among the white and colored population living in urban and rural districts.

How much greater the typhoid mortality is among the colored population is made clear, and it is shown that whereas the white rural typhoid death rate is 11 per cent in excess of the urban typhoid death rate, the colored rural typhoid death rate is 14 per cent in excess of the urban typhoid death rate. This difference is not particularly marked, but it is significant, nevertheless, as indicating that as regards rural sanitation the colored population is even worse off than is the white population.

PLATE V



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CONSULTING ENGINEER
NEW YORK CITY

TABLE 12

*White and colored typhoid fever death rates in rural and urban districts (per 100,000 population living)*

| STATE | RACE | 1911 | | 1912 | | 1913 | | AVERAGE | |
|---|---|---|---|---|---|---|---|---|---|
| | | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban |
| Indiana | White | 26.5 | 27.2 | 20.7 | 28.6 | 23.4 | 26.8 | 23.5 | 27.5 |
| | Colored | 25.9 | 26.2 | 62.8 | 28.1 | 43.0 | 54.9 | 43.9 | 36.4 |
| Kentucky | White | 46.5 | 29.3 | 33.7 | 20.7 | 43.6 | 23.3 | 41.3 | 24.4 |
| | Colored | 70.7 | 56.1 | 49.1 | 67.9 | 69.1 | 44.9 | 63.0 | 56.3 |
| Maryland | White | 37.9 | 29.2 | 22.6 | 26.4 | 27.7 | 25.6 | 29.4 | 27.1 |
| | Colored | 65.7 | 39.0 | 49.2 | 33.1 | 70.5 | 52.5 | 61.8 | 41.5 |
| Missouri | White | 34.8 | 24.3 | 26.2 | 14.0 | 25.4 | 21.1 | 28.8 | 19.8 |
| | Colored | 51.6 | 41.6 | 70.7 | 24.6 | 35.0 | 36.8 | 52.4 | 34.3 |
| North Carolina | White | 66.9 | 67.7 | 36.4 | 31.5 | 49.2 | 52.5 | 50.8 | 50.6 |
| | Colored | 88.8 | 58.6 | 48.6 | 53.5 | 55.9 | 86.6 | 64.4 | 66.2 |
| Ohio | White | 22.6 | 22.6 | 16.6 | 19.1 | 24.7 | 22.1 | 21.3 | 21.3 |
| | Colored | 29.1 | 28.8 | 33.9 | 39.3 | 41.2 | 47.8 | 34.7 | 38.6 |
| Pennsylvania | White | 20.0 | 23.9 | 16.4 | 16.5 | 16.1 | 19.6 | 17.5 | 20.0 |
| | Colored | 32.3 | 21.5 | 14.5 | 15.8 | 27.5 | 34.3 | 24.8 | 23.9 |
| Averages | White | 36.5 | 32.0 | 24.7 | 22.4 | 30.0 | 23.7 | 30.4 | 27.2 |
| | Colored | 52.0 | 38.8 | 47.0 | 37.5 | 48.9 | 51.1 | 49.3 | 42.5 |

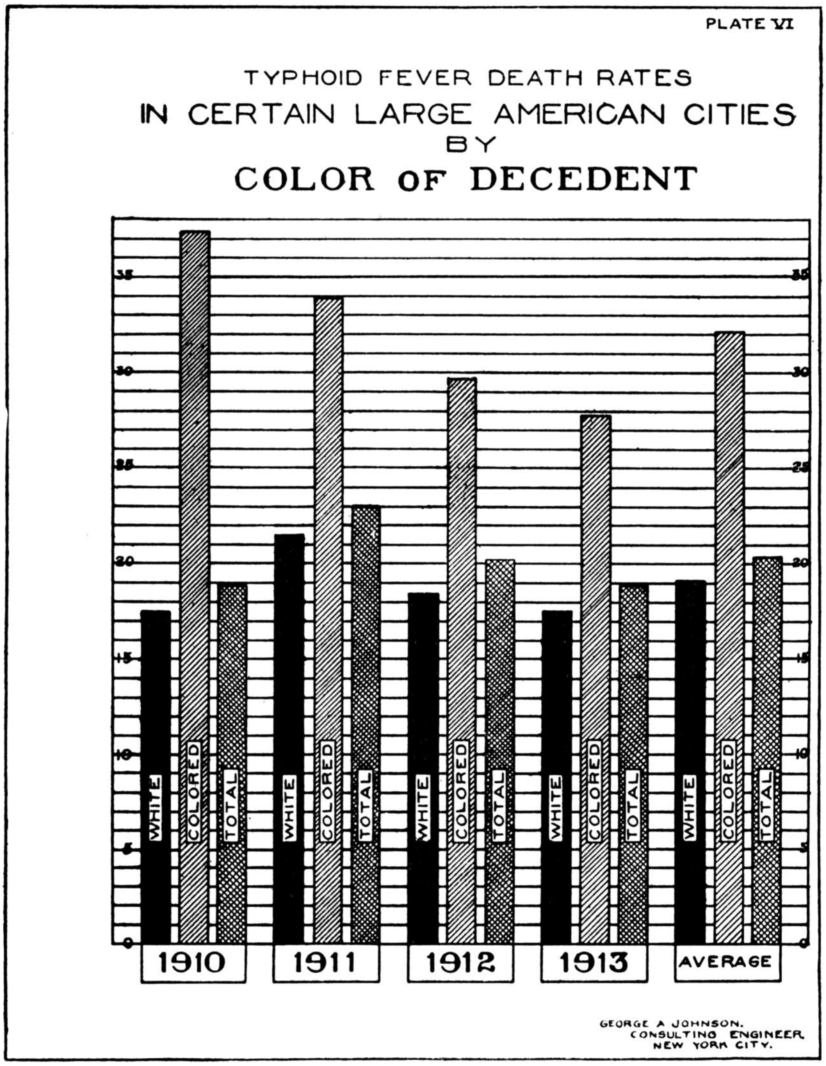
Table 13 and Plate VI show a digest of the statistics on typhoid fever among the white and colored populations of twenty-four well scattered large American cities, see Appendix, Tables 31 to 34 inclusive. The four-year survey of these data, 1910 to 1913, inclusive,

TABLE 13

*White and colored typhoid fever death rates (average for four years—1910 to 1913 inclusive)*

| YEAR | DEATHS FROM TYPHOID FEVER | | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION LIVING | | | PER CENT WHICH WHITE DEATH RATE WAS OF TOTAL TYPHOID FEVER DEATH RATE |
|---|---|---|---|---|---|---|
| | White | Colored | White | Colored | Total | |
| 1910 | 2415 | 354 | 17.5 | 37.3 | 18.8 | 93.1 |
| 1911 | 2519 | 364 | 21.5 | 33.8 | 23.0 | 93.5 |
| 1912 | 1656 | 295 | 18.4 | 29.6 | 20.1 | 91.5 |
| 1913 | 1704 | 293 | 17.5 | 27.8 | 18.8 | 93.1 |
| | 8294 | 1306 | 18.7 | 32.1 | 20.3 | 92.7 |

shows that on an average the typhoid fever death rate among the colored population of these twenty-four large cities was 72 per cent in excess of the white typhoid death rate. Due to the preponderant white population, the total typhoid death rate is increased by the high colored rate by less than 9 per cent.



A somewhat peculiar phenomenon, and likewise encouraging indication, is the fact that while the white typhoid death rate in these cities fell slowly during the four-year period, the decrease in the colored rate was even more pronounced, the annual percentage reductions, as compared with the year previous, being 9, 12 and 6, respectively. This savors of better general municipal sanitation in the residential districts of the lower classes.

### HOW TYPHOID FEVER IS CONTRACTED

All typhoid fever is caused by a specific germ, the Bacillus typhosus, first discovered by Eberth in 1880 in the mesenteric glands and in the spleen of persons dying from typhoid fever.

Starting from the alimentary tract, which may be said to be its habitat, whether its host is actually suffering from typhoid fever or is a chronic carrier of the germ, it is discharged in the urine, feces, and, in rare cases, in the perspiration and the sputum of the host. The typhoid bacillus may now be said to be at large, and consequently a potential menace to the health of the public. The various ways in which well persons may receive the germ, and perhaps contract typhoid fever, are well nigh incapable of accurate listing, but in the following pages some of the more common easy avenues are mentioned.

### TYPHOID INFECTION THROUGH DIRECT CONTACT

Typhoid fever, while not in a strict sense contagious, is unquestionably communicable, and a large share of the typhoid fever cases are caused by direct contact of a well person with a person suffering from this disease. The important rôle played by the typhoid carrier in this connection will be discussed under a separate heading.

Where others ministering to the wants of the typhoid patient soil their hands with the typhoid infected excreta, and later convey it to their own mouths, direct contact infection may result. Where those whose duty it is to attend to the excreta of typhoid patients, soil their hands with it, and do not carefully wash and sterilize them in consequence, and thereafter handle and contaminate the food and drink of others, or even the utensils from which they are consumed, indirect contact infection may follow. Even the use by well persons of towels soiled by others with typhoid matter can cause typhoid infection.

The person attendant on a typhoid patient must constantly be on guard against the possibility of infecting himself or others. He is constantly touching the patient, taking away his excretions, bathing him, and changing the bed linen which is almost certain to be infected. Freely granting all that anti-typhoid vaccine can do, the only way in which an attendant can be absolutely assured of freedom from self infection is to carefully wash and disinfect his hands after each contact with the patient; and it is most important that he keep his hands out of his own mouth. All instruments, dishes, cutlery and bed linen should be subjected to immediate disinfection after use by the patient, and, although it is almost never done, the attendant's clothing should be changed completely on leaving the room to come in contact with others.

Persons visiting the patient should first be cautioned not to come in actual contact with him, and it would be the height of good practice to provide each visitor with sterilized gloves, slippers and full length coat before entering the room. And yet, where the patient is cared for in his own home, how often other members of the family come in contact with him, and thereafter fail to exercise even the most elementary precautions. The sequential result often is a case of direct infection. Where several cases occur in the same family, all following some days after the first case, the evidence is strongly in favor of contact infection.

The spread of typhoid fever by contact is one of the most common modes of dissemination. As is well known, the discharge of the typhoid germs begins some ten days before the patient actually becomes ill, consequently it is obvious that by handling or using bedding, clothing, towels, food, and many other things used by others, he may be the cause of their infection with the disease of which he is about to suffer. Thus, within a few days or weeks, there often appear several cases of typhoid fever within the same house, the source of the infection being the single original patient.

Those attendant on a typhoid patient who fail to exercise the required measures of precaution, and to keep their hands and clothing free from such infectious material as may adhere to them when caring for the wants of the patient, in the pursuance of their other duties may contaminate the food and drink of others, and thus serve as the connecting medium between the sick and the well.

The limits to which this thought can be carried are terrifying. A member of the household contracts typhoid fever. The other members of the household attend the wants of the patient and unwittingly carry infected material away from the bedside on their hands. Perhaps the sale of dairy products is one of the means of livelihood of that household, and so conceive that the person with contaminated hands attends to the preparation of the products for the market. The milk, and maybe the butter and cheese are thus contaminated, and all are admirable culture media for the typhoid germ. The infected products are distributed in several different families, and the original patient, through the carelessness of the well members of his household, thus serves as the originator of several other foci of the disease. It becomes a sort of endless chain. The same thing applies in a lesser sense where raw vegetables and fruits are sold or prepared for the table by one whose hands are soiled with typhoid infected excreta.

In practically every epidemic of typhoid fever secondary cases appear after the initial outbreak. When the original source of the primary infection has been located and eliminated, these secondary cases continue to appear. They usually come from contact infection. An investigation made in Washington in 1906–1907, showed that about 13 per cent of the cases obtained their infection from contact with other cases, and led to the following statement:

> This gives us our cue for one of the most important and practical measures to prevent the further spread of the infection. Every case of typhoid fever, every case of suspected typhoid fever, and every case of continued fever until the diagnosis is settled, should be treated as typhoid fever, isolated, and disinfection practiced so as to prevent the spread of the infection. If these measures are conscientiously and aggressively carried out they will largely diminish the amount of the disease in this or any other city. We must learn that a case of typhoid fever may be just as dangerous to a community as a case of small-pox, scarlet fever or cholera. The discharges should be disinfected as they leave the body and before they have a chance to contaminate the environment.

Perhaps the most striking instance of secondary infection was unearthed by Dr. E. O. Jordan while investigating the undue prevalence of typhoid fever in Winnipeg in 1900–1903. In the course of a house to house canvass of one district, by no means the worst, he found secondary cases in 56 per cent of the houses.

### TYPHOID CARRIERS

When once a person has had typhoid fever, and has recovered, it frequently happens that it may become established in a chronic form, and the specific germ of the disease be discharged by the "carrier" for many years. The records are clear in showing that people have carried the germ for over fifty years, and all the time gave no external sign of having the disease.

Reliable investigators have estimated that 4 per cent of the convalescents from typhoid fever become chronic "typhoid carriers." One investigator figures that at the present time there are 20,000 persons in the United States, all apparently enjoying good health, who carry the germ of typhoid fever, and who must be looked upon as a threat against the public health. There are some 300,000 new cases of typhoid fever in the United States each year, and 4 per cent of these, representing the newly made carriers, amounts to 12,000, consequently the above figures of 20,000 would appear all too low an estimate of the number of chronic "typhoid carriers" in the United States at the present time.

The typhoid carrier is the keenest sort of menace when his or her occupation is in the line of purveying milk and other foods. A recent investigation of the employees of hotels and public restaurants in New York City disclosed the fact that some 4 per cent of the employees, whose duty it is to handle food and drink for consumption by others, are infected with some form of communicable disease.

Perhaps the most spectacular case of a typhoid carrier, due chiefly to the advertising it received, was that of "Typhoid Mary," a cook, who, during her active career, was the innocent cause of twenty-six cases of typhoid fever in seven different families. When the facts become known she was kept under enforced control until public clamor against such a proceeding resulted in her being set free. This was a splendid example of the failure of the general public to realize the truthfulness of Hutcheson's claim that

> That action is best which procures the greatest happiness for the greatest number.

While there are scores of cases on record, for the purposes of this paper only one specific case of the damage wrought by a typhoid carrier will be recited. This is taken from the Thirty-seventh

Annual Report of the State Board of Health of New Jersey. It appears that for a period of some fifteen years many cases of typhoid fever had occurred among the members of a certain farmer's family, and other persons intimately associated therewith, residing in Raritan Township, Monmouth County, and the source of the infection of these cases had never been definitely determined. On investigation the following history was procured:

> During the summer of 1896 the farmer, his wife, three sons, two daughters and several employees resided on the place. The eldest son, then 16 years of age, left home to accept employment in a store in South River, and after an absence of several weeks he returned ill with what proved to be typhoid fever. There was no previous history of typhoid fever in this family nor on the farm.
>
> Within the next few weeks the boy's father, then about 43 years old, his sister, then 6 years of age, and several employees on the place contracted the disease. After the son's recovery, he again left home and has not since that time resided on the farm. Subsequent to this original case, the well that had previously furnished water for potable purposes was filled up, as the result of a chemical analysis, and a new one was dug. Still other cases of typhoid fever continued to occur, from year to year, in persons residing at or working on the farm, with the result that further improvements were made in and about the house and buildings; and eventually a third well was procured far remote from any apparent sources of pollution. These changes were followed with additional cases of typhoid fever and during the summer of 1903 another son, then 19 years of age, suffered an attack of the disease. During the fall of 1908 this son was married and brought his wife to occupy a newly constructed dwelling on another portion of the farm, and in July, 1910, she contracted typhoid fever. In September, 1912, their three-year old son fell a victim to the disease.
>
> Covering a period of sixteen years, dating from the original case brought to the farm during the summer of 1896, to the date of occurrence of the last case above referred to, 18 cases of typhoid fever are known to have occurred in persons who had either resided on the farm in question or who were closely associated with those who did.
>
> Of the persons included among those in whom the above cases occurred there remained resident on the farm, at the time this inquiry began, the father and two daughters, living in the homestead, and the son together with his wife and child, occupying the house constructed in the year 1908. Two of the six persons named suffered from typhoid fever in 1895, one in 1903, one in 1910, one in 1912, and the sixth at some period of time during these years, the exact date not being definitely ascertained.
>
> From the history procured there appeared no reason to suspect the water supply now in use in either of the two dwellings, nor to believe that other structural conditions about the well kept buildings and farm have been responsible for continuing the infection. On the other hand, it seemed more probable that some one of the persons who had suffered an attack of typhoid

fever during the year 1896 had become a chronic "carrier" and, as such, the source of infection of the subsequent cases.

As a preliminary step toward locating such a possible "carrier," specimens of blood for Widal reaction were taken from the following persons:

| PERSON | AGE | HAD TYPHOID FEVER | DATE SPECIMEN WAS TAKEN | RESULT OF EXAMINATION |
|---|---|---|---|---|
| Father....... | 59 | August 1896 | November 6, 1912 | Positive |
| Daughter.... | 22 | September 1896 | November 6, 1912 | Positive |
| Son.......... | 28 | July 1903 | November 6, 1912 | Negative |
| Son's wife.... | 27 | June 1910 | November 6, 1912 | Positive |

Assuming that a positive blood reaction means that the body of the individual from whom it is taken then or has recently harbored the typhoid bacilli, the results above shown are rather remarkable, inasmuch as they indicate three typhoid "carrier" cases out of four persons whose blood was tested; two sixteen and one two years after recovery from an attack of the disease. It therefore appeared that at least two persons residing in the homestead on the farm had been constant or intermittent sources of infection for a period of sixteen years past, and that one "carrier" has existed in the new dwelling for more than two years past. It is quite probable that another daughter in the family, who gives a past history of malarial fever, but whose blood was not tested, may also have suffered from typhoid fever. The natural inference deduced from the data in hand up to this time was that the son's wife, who had typhoid fever in June, 1910, contracted the disease from a "carrier" case in the home of her father-in-law, where she frequently ate food, and that she subsequently infected her own child, who was ill with the disease during the month of September, 1912.

The results and significance of the blood examination were explained to the persons from whom the specimens had been taken and the desirability of continuing the investigation, by the examination of specimens of feces and urine, was pointed out. It was also explained that these examinations would be made by the State Board of Health without expense to the families concerned. The essential precautionary measures that typhoid "carriers" should observe were carefully gone over in detail, and the dire results that might follow disregard of scrupulous personal cleanliness and the safe disposal of all excretions from such individuals were particularly dwelt upon.

While the members of the affected family were naturally much disturbed by the realization of their predicament, and somewhat dismayed at the prospect that several of them might continue, for an indefinite period, to be sources of typhoid infection, the offer of assistance in carrying the inquiry to a satisfactory termination was rejected and no further specimens were furnished, nor did the persons whose blood gave a typhoid reaction seek remedial treatment.

Attention was next called to this family on April 14, 1913, while investigating a small but explosive outbreak of typhoid fever in the Borough of Keyport. In seven cases of the disease, occurring in six houses, the dates of onset were found to have been about April 1st. As a result of a careful study of the individual cases, suspicion fell upon milk that had been supplied by a small local dealer. It appeared from the epidemiological study of this outbreak that the dealer distributed about 60 quarts of milk a day to a small number of families residing in the Borough of Keyport. Of this amount the dealer produced about 15 quarts daily and purchased from four nearby farms various amounts sufficient to meet his daily sales. No recent nor remote typhoid history was associated with any of the dairies then contributing to the supply. In checking up the dates to learn when the dealer began to take milk from each of these four farms, it appeared that one had been taken on about March 15, 1913, and a former contributor (of from 5 to 8 quarts a day) had been dropped on March 20th. The discontinued supply proves to have been obtained from the farm about which typhoid infection has centered for so may years, and upon which the three "carrier" cases referred to above were located.

According to information procured, the farmer and his son each kept one cow to supply milk for their respective families, and when the supply exceeded the amount required for home consumption the excess was disposed of to the milk distributor above referred to who had been taking this excess milk for sale in Keyport since going into business about one year before. Both cows were stabled in the barn at the homestead, and had been milked and cared for by the son prior to his departure with his family from the State on March 5, 1913.

Following the son's removal from the "typhoid-carrier farm" a hired man did the milking until the cow that had belonged to the son was sold, on or about March 20th, after which time the local dealer procured no more milk from this farm. On two or three occasions, just prior to the sale of this cow and some time between March 15th and 20th, the farmer, whose blood had given an absolute typhoid reaction, did the milking in order that the hired man should not be put to the inconvenience of coming from his home, a mile or more distant, for this express purpose on these particular occasions. It was some time between March 15th and 20th that infection of the cases of typhoid fever that occurred in Keyport took place.

For obvious reasons, it was not possible to definitely prove how and where the milk distributed by the dealer became infected, but the strong presumptive evidence is that it was the result of the infected farmer's obliging act in milking the cows on two or three occasions at about the time the infection occurred.

Justification for this assumption is to be found:

1. In that no typhoid history was revealed on the milk dealer's farm nor among any of those contributing to this supply except the one referred to above.

2. During the period of time that the son (whose blood did not give a Widal reaction) did the milking no infection of the milk appears to have occurred.

3. The hired man, who usually did the milking on the infected farm after the son's departure, had for years kept and milked several cows at his own home, and personally distributed milk to consumers, among whom no cases of typhoid fever occurred.

4. The farmer, whose blood gave an absolute typhoid reaction milked the cows on one or two occasions about the time that persons using this milk in the Borough of Keyport became infected.

The dealer who distributed the infected milk retired from the business as soon as it was shown that he had presumably, yet unknowingly, played a part in the spread of infection that resulted in ten cases of typhoid fever and two deaths, while the original source of infection that caused the outbreak evidently remains as potent a factor of danger as at any previous time.

Thus it is easy to understand the continuous menace which the chronic typhoid carrier is to the public at large, and it is very clear that there should be a registration system for them. They should be educated in the necessary precautionary measures to be taken, and so long as they are shown to be active disseminators of the typhoid germ they should be prohibited from engaging in vocations involving the handling of the food and drink of others, and should be required to report at stated intervals to the health authorities for examination. In other words, their personal habits should be a matter of continuous record so long as they are shown to be carriers of the typhoid germ.

## INFECTION FROM CONTAMINATED FRUIT AND VEGETABLES

The farmer with an extensive truck garden is an object of rural envy. Very often this garden is fertilized entirely with the contents of the farmer's privy, although he is not always particular about that, not refusing to use the contents of his neighbor's privies if he can get them for nothing, as he often can. There may be the undisinfected excrement of typhoid patients in this material, but this not being known, or its significance understood, it is not wasted on that account. It is not difficult to conceive of typhoid infected lettuce, radishes, tomatoes, strawberries and other foods which are consumed raw, coming from such a garden. In far eastern countries human excrement is used very largely in the fertilization of truck farms, for other forms of natural fertilizers are not available, and artificial fertilizers are too expensive. It is noteworthy, however, that old foreign residents of those countries will not eat foods of this character unless they are grown by themselves. They know the danger in so doing.

In the sidewalk markets, seen in all cities and large towns, fruits and vegetables are exposed for sale. The word "exposed" is used advisedly, for without being exposed the insanitary house fly could not speed to them from the filth of the nearby gutter, nor could the introspective housewife paw over the stock with hands perhaps soiled with the excrement of a typhoid sufferer in her home. After her comes another of clean habits who buys the stuff the other has handled and effectually contaminated, and later in her home there appears a case of typhoid fever, the source of infection of which naturally is obscure. This thought could be dwelt on indefinitely.

### CONTAMINATED SHELLFISH

Oysters grow best in sewage polluted surroundings. Where they grow in clean, unpolluted territory they usually are dark in color, and lack the nice, fat, healthy appearance of the oyster which feeds on sewage. If grown in unpolluted waters the oysterman, to improve their bulk and appearance, transports them to a brackish estuary where they are "drinked" or "floated," and by this treatment become lighter colored and fat in appearance. An oyster filters many gallons of water each day, and in this way obtains its nourishment. If the water is sewage polluted, and very commonly it is, the oyster may take into its system as food myriads of typhoid germs. Such oysters, eaten raw, serve as admirable media for the transmission of typhoid germs from sick to well persons, and when pleasantly warmed through, as in the case of the only entirely acceptable form of stewed oysters, its value as a typhoid medium is but slightly lessened.

### INFECTION THROUGH THE MEDIUM OF THE HOUSE FLY

The common house fly feeds voraciously on typhoid infected excreta, in the sick room or privy, and finding access to food and drink thus conveys on its feet the noisome, typhoid-infected filth from the sick to the well. It is really astonishing how slowly this perfectly obvious method of spreading typhoid fever is growing in the public mind. Among the lower classes it is generally unknown and unheeded, and even among the classes of higher intelligence the slogan "Swat the Fly" often falls upon unheeding ears, or is jocularly referred to as the new king of indoor sports.

Where there is a typhoid patient in a house, one of the quickest and surest ways of conveying the typhoid germ from the sufferer to the remainder of the family is to deposit the patient's undisinfected excrement in a privy or exposed place, and leave the rest to the flies, who can always be counted on at each meal time to forsake their repulsive explorations of fecal deposits for the family dinner table. And on their feet they bring to the table the typhoid germs, with which their abruptly, but only temporarily, deserted feast of filth is populated. A fly census taken in the privy at meal time would be most unproductive, for at those hours the fly population is being entertained by the human family at the dinner table.

The itinerant fish man and butcher, selling his wares from the tailboard of his wagon, always carries a sizable freight of house flies, and more than likely these uninvited passengers have only just left the family manure pile for the sake of a free ride and plenty of desirable food. To be sure, the wares of the butcher and fish man are cooked before consumption, but the flies are not, and usually with each sale a few flies are thrown in for good measure, to hover about the house until dinner is ready, then again to attack and contaminate the foods of which they temporarily have been deprived.

TABLE 14

*General prevalence of flies in Brooklyn*

| WEEK ENDING | NUMBER OF FLIES CAUGHT DURING THE WEEK | WEEK ENDING | NUMBER OF FLIES CAUGHT DURING THE WEEK |
|---|---|---|---|
| June 1 | 7 | August 24 | 281 |
| June 8 | 36 | August 31 | 99 |
| June 15 | 142 | September 7 | 344 |
| June 22 | 287 | September 14 | 497 |
| June 29 | 872 | September 21 | 521 |
| July 6 | 1460 | September 28 | 411 |
| July 13 | 2348 | October 5 | 182 |
| July 20 | 2952 | October 12 | 205 |
| July 27 | 3813 | October 19 | 180 |
| August 3 | 4202 | October 26 | 68 |
| August 10 | 3015 | November 2 | 59 |
| August 17 | 1175 | | |

In making a study of the seasonal prevalence of the house fly, Mr. D. D. Jackson, in 1907–1908, placed fly traps in different parts of New York City, and counted the number of flies caught in them. The results he obtained are instructive in showing the relatively small number of flies during the spring, the rapid increase in number with the advent of summer, and the slow decrease as colder weather sets in. It is interesting to compare the results contained in Table 14 with those in Table 8 and Plates II and III, as indicating one reason for the high summer typhoid, and its slow decline in the late fall.

Another striking connection between the house fly and typhoid fever is the case of Jacksonville, Florida. Prior to 1910 the privies of the city were often open and accessible to the house fly. In 1911 these closets were all made flyproof, so far as possible. The effect of this improvement on the health of the people of Jacksonville is well shown by the marked decrease in the number of typhoid cases which followed the screening of the privies. These statistics are given in Table 15 and Plate VII.

TABLE 15

*Typhoid fever cases in Jacksonville before and after making the privies fly proof*

| MONTH | 1910 | 1912 |
|---|---|---|
| | Before the privies were made fly-proof | After the privies were made fly-proof |
| January | 8 | 9 |
| February | 0 | 5 |
| March | 4 | 7 |
| April | 6 | 4 |
| May | 41 | 11 |
| June | 41 | 18 |
| July | 109 | 10 |
| August | 82 | 5 |
| September | 14 | 7 |
| October | 15 | 8 |
| November | 7 | 2 |
| December | 2 | 4 |
| Total | 329 | 90 |

## CONTAMINATED WELLS

The excreta of typhoid sufferers always should be thoroughly disinfected, but the cases are very numerous where it is either not done at all, because of the unpleasant labor involved, or done in a perfunctory manner. Where there is no water carriage system of sewerage these infected discharges are emptied in the privy or some other convenient place, sometimes being covered with earth, but more often not, and from these deposits, where favorable geological

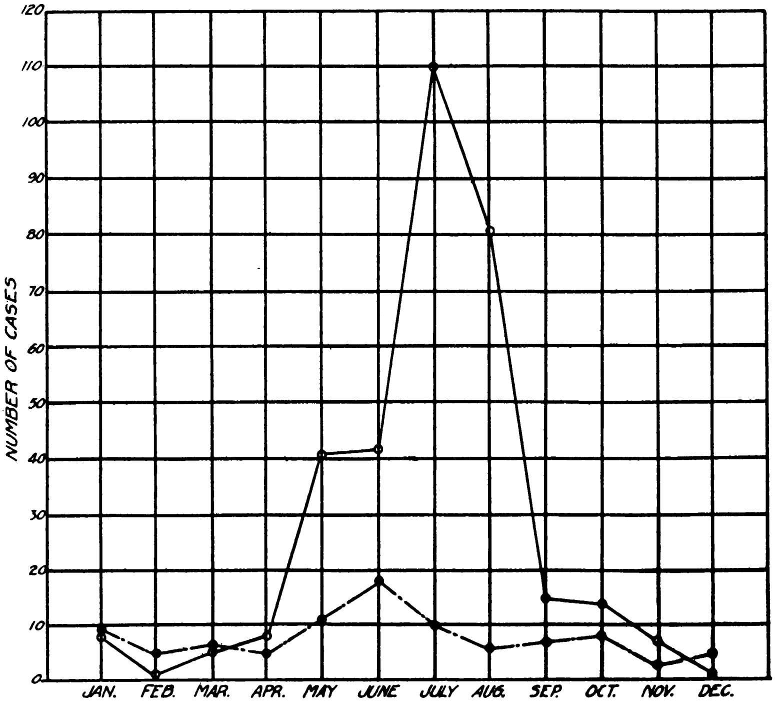
PLATE VII

DIAGRAM SHOWING SEASONAL DISTRIBUTION OF TYPHOID FEVER

JACKSONVILLE, FLA.

TYPHOID CASES 1910 ——○—— BEFORE CLOSETS WERE MADE FLY PROOF
" " 1912 —·—●—·— AFTER CLOSETS WERE 100% SCREENED

SEE ANN REPT BD. OF HEALTH 1911 P.16
" " " " " " 1912 P.46
" 13TH CENSUS VOL. I P. 88
POPULATION 1910 - 57,699



GEORGE A. JOHNSON.
CONSULTING ENGINEER,
NEW YORK.

and topographical conditions obtain, the typhoid germ easily finds its way through or over the ground into nearby wells, which serve as sources of drinking water for one or more families.

The attendants on a typhoid sufferer not infrequently regard the urine of such a patient as innocuous, and since it is less trouble it is emptied into a nearby sink or out of a back window. It has been positively demonstrated that the urine of a typhoid patient may contain as high as 1 to 500,000,000 typhoid germs per cubic centimeter, or from 5 to 25,000,000 in a single drop, and this is sufficient to show its very dangerous character, particularly in the contamination of dug wells.

A summary of the results of a large number of examinations made of wells located on farms in eastern and western United States showed that at least 60 per cent of the wells examined were contaminated with bacteria which are always identified with sewage. There is no doubt that a fair share of the annual typhoid grist comes from the consumption of polluted well waters, either through direct consumption, or through the contamination of milk and other foods which are brought in contact with them.

## WHOLESALE POLLUTION OF PUBLIC WATER SUPPLIES

Where the house of the typhoid sufferer is provided with a convenient water closet, the temptation is great for the attendant to eschew the disagreeable task of effective disinfection, and the excreta, without such treatment, are summarily dumped therein to find unimpeded transit facilities to the nearest water way, from which others draw their water supplies. It may be that the sewage of such communities is subjected to some form of purification before it is allowed to flow into the nearest waterway, but no form of treatment used in any part of the world at all times actually destroys all of the disease germs in such sewages. It remains for those communities whose water supplies are thus polluted to purify them before consumption. If this is carefully done, all is well; if not, then there is always a heavy endemic toll of typhoid fever in those communities, the sodden monotony of which frequently is broken by a spectacular epidemic.

## WATER BORNE TYPHOID FEVER EPIDEMICS

When the amount of typhoid fever in a community suddenly increases in a material degree the disease is said to be epidemic. Many cities have shown gradually increasing annual typhoid fever death rates and paid little or no attention to the matter, but when this additional harvest of typhoid fever deaths has occurred within a short space of time, the conviction usually is driven home that something is out of joint, and a flurry of investigation follows. This frequently shows that the public water supply, known to be "moderately" polluted, just prior to the outbreak received an unusual amount of disease bearing contamination; or that, although supposedly unpolluted, it became suddenly infected at that time.

In the former class of epidemics notable examples on record are those in the cities of Lowell and Lawrence, Massachusetts; Waterville and Augusta, Maine; Burlington, Vermont; Erie and Pittsburgh, Pennsylvania; Cleveland, Ohio; Chicago, Illinois; Milwaukee, Wisconsin; Minneapolis, Minnesota; Kansas City, Missouri, and Omaha, Nebraska. Details of many of these outbreaks can be found in Whipple's "Typhoid Fever." They all were traced positively and directly to the polluted water supply.

The epidemic typhoid in these cities during periods ranging from less than one year to nine years, in which from one to twelve distinct epidemics occurring in a single city, cost 6700 lives, and a loss in vital capital of $50,000,000, or roughly thirty-three times the cost of permanent prevention through filtration of the water supply. In all of these cities the officials well knew that the public water supply always was contaminated, or liable to contamination, by the sewage of other communities, yet they delayed taking the necessary steps until an epidemic, or a series of epidemics, forced them to action.

In the second class of epidemics, occurring in cities where the water supply was supposedly uncontaminated until the cause of a sudden outbreak of typhoid was traced direct to the water, notable examples on record are those at Plymouth, and Scranton, Pennsylvania; New Haven, Connecticut; Ithaca, New York, and Mount Savage, Maryland. While less fatal, numerically, these epidemics were more spectacular in their character, since the possibilities of contamination of the water supply seemed so remote. At Mount Savage a hillside spring supply became contaminated; at Scranton a storage reservoir, holding over a thousand million gallons of water, suddenly became infected; at Plymouth and New Haven the water supply was taken from watersheds but sparsely populated, yet one case of typhoid on each of these watersheds resulted in epidemics of typhoid fever in those cities. The infected excreta which had been cast on the ground during the winter was washed by heavy rains into the streams from which the supplies were taken, and thus infected the water. The conditions surrounding the Ithaca epidemic were much the same.

In these few examples, and there are many more on record, the danger in unpurified water supplies stands forth prominently. Even in these single epidemics in five communities, two of which were large cities, four hundred lives were sacrificed to the insatiable appetite of the typhoid fever plague. This represents lost vital capital in the amount of $3,000,000, or fifty times the cost of pure filtered water at all of these places.

## SEWAGE TREATMENT TO MINIMIZE WATER POLLUTION

The rural pollution, despite such local efforts as are made to minimize, or at least to control it, remains at all times a potent factor. Sewage treatment in the large community centers materially reduces the dangerous pollution, but it does not make safe for human consumption the waters of the streams into which the sewage effluent is discharged. Filtration of such waters is the only way to make them entirely safe.

Sewerage is helpful in municipal sanitation in that it removes the house drainage from the street gutters and causes the abolishment of the privies, and both of these are among the chief sources of maintenance of house fly life. Sewage purification aids the cause of general sanitation more than it really improves the hygienic quality of public water supplies. It tends to preclude the establishment and maintenance of offensive odors of putrefaction from polluted public waterways, and aids in the support of fish life. It prevents such bodies of water from becoming eyesores, but it does not make them drinkable without artificial purification.

The dream of the sewage treatment idealist was to make the sewage of cities innocuous, but the best disposal plants of size, even where sterilization is an important adjunct, have never succeeded in the complete and continuous destruction of disease germs in sewage. It is not difficult to understand why. In the sewage collection systems of many cities there are some sewers which carry not only the house sewage but street wash as well. These sewers are provided with storm overflows which open automatically during heavy rains when the capacity of the sewer becomes overtaxed. The sewage thus bypassed direct to the stream is a combination of fresh house sewage and street wash. A little of this is often more dangerous, that is, contains more disease germs in a state of unimpaired virility, than the larger bulk of the sewage which flows through the main sewer to the disposal plant, and is there purified before it is finally discharged into the stream.

Then, too, all sewage treatment plants are liable to derangement at times, and such interruptions in the regular order of operation of the various parts of the plant cause the final effluent to enter the stream but partly purified. This is no secret in any city, although special bulletins are never posted declaiming the fact.

In the final analysis, sewage treatment works are necessary in keeping public water ways clean, that is, inoffensive to the senses of sight and smell. Further than this they do, of course, effect the destruction of a large proportion of the disease germs in the raw sewage. They cannot be depended upon for the complete annihilation of all such germs, therefore public waters receiving purified sewage are less dangerous only for the reason that they will likely contain fewer disease germs than waters receiving the sewage in its crude state. It remains for the water itself to be purified before it can be drunk with safety.

## EFFECT OF WATER PURIFICATION ON THE TYPHOID FEVER DEATH RATE

Dr. Allen W. Freeman, Assistant Commissioner of Health of Virginia, recently said:[2]

> We have learned by sad experience that the measure of typhoid fever in any community is the measure of the distribution of human filth in that community, and that the dissemination of human excrement will inevitably result in the spread of typhoid fever . . . . The problem is no longer an investigative or scientific problem, but a problem of administration. When

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[2] The Present Status of our Knowledge Regarding the Transmission of Typhoid Fever, Public Health Reports, issued by the United States Public Health Service, January 10, 1913.

> the people of the United States wish to pay for absolute protection against typhoid fever it can be bought with the full assurance that the goods can be delivered. As physicians and sanitarians, we are most interested in the practical question, can typhoid fever be prevented? We know that it can. We know that our methods are certain, that they will yield the desired result in every case where they are properly applied. The problem remaining for solution is how to convince the American people that protection from typhoid fever is something worth spending money for.

Dr. Freeman estimates that in the northern part of the United States the purification of all water supplies would result in the reduction of the annual typhoid rate to a figure usually less than twenty per hundred thousand population, while in the south the purification of the water supply alone would seldom reduce the rate to less than fifty per hundred thousand, other measures, such as perfect sewering or rigid screening and supervision of dry closets, being required to bring down the rate to the point which could be reached in the north by water purification alone. Below this point, in the north and south alike, reduction must be attained by the thorough supervision of cases of illness, which means the requirement of morbidity returns and the prompt notification of all suspicious cases, protection of milk and other foods from typhoid contamination, elimination of flies and their breeding places, control of typhoid carriers, and the use of anti-typhoid vaccine whereever feasible.

Dr. Freeman's viewpoint is unquestionably sound, but in the broad analysis his estimates of what filtration would do are perhaps a little too low. For years it has been recognized that efficient filtration of the public water supply of a community will result in a reduction of from two-thirds to three-quarters in the typhoid fever death rate. Where the initial rate is high the percentage reduction following filtration of the water supply usually is correspondingly high, as noted particularly in the cities of Albany, Cincinnati, Columbus, Lawrence, Philadelphia and Pittsburgh. In these cities the average typhoid fever death rate for the five year periods before and after filtration, respectively, showed a reduction of 76 per cent, or a typhoid fever death rate per 100,000 population of seventy-nine reduced to nineteen. The combined result of water filtration in twenty representative cities showed that filtration was followed by an average reduction in the typhoid fever death rate of 65 per cent.

In southern cities it is difficult for filtration to make as favorable showing as in the north, for the reason that causes other than impure water are more prevalent and active in the south. Particularly is this true with respect to the house fly and the open privy. The case of Jacksonville is enlightening on this point.

TABLE 16

*Reduction in typhoid fever death rates in American cities following the filtration of their public water supplies (Averages for five years before and five years after filtration)*

| CITY | AVERAGE TYPHOID FEVER DEATH RATE | | PER CENT REDUCTION IN TYPHOID FEVER DEATH RATES WHICH FOLLOWED THE FILTRATION OF THE PUBLIC WATER SUPPLY |
|---|---|---|---|
| | Before Filtration | After Filtration | |
| Albany, N. Y. | 109 | 28 | 74 |
| Charleston, S. C. | 106 | 62 | 41 |
| Cincinnati, O. | 56 | 11 | 80 |
| Columbus, O. | 83 | 17 | 78 |
| Harrisburg, Pa. | 72 | 33 | 54 |
| Hoboken, N. J. | 18 | 13 | 28 |
| Indianapolis, Ind. | 46 | 28 | 39 |
| Lawrence, Mass. | 110 | 23 | 79 |
| Louisville, Ky. | 57 | 24 | 58 |
| New Haven, Conn. | 40 | 25 | 38 |
| New Orleans, La. | 39 | 26 | 33 |
| Paterson, N. J. | 29 | 9 | 69 |
| Philadelphia, Pa. | 63 | 20 | 68 |
| Pittsburgh, Pa. | 132 | 19 | 85 |
| Providence, R. I. | 19 | 13 | 31 |
| Reading, Pa. | 53 | 35 | 34 |
| Scranton, Pa. | 25 | 10 | 60 |
| Springfield, Mass. | 22 | 22 | 0 |
| Washington, D. C. | 55 | 31 | 43 |
| Wilmington, Del. | 35 | 24 | 31 |
| Weighted averages | 60 | 21 | 65 |

The raw water supplies of the south are no more badly polluted than those of the north, and filtration is quite as efficient, but the influence of the water borne typhoid on the typhoid fever death rate is deeply overcast by the high death rate emanating from sources of infection other than the water supply. Thus, in the list of cities just given, Charleston, Louisville, New Orleans and Washington have efficient filter plants, yet filtration of the water supply reduced the typhoid fever death rate by only 41 per cent.

Among sanitarians there appears to be little if any dissention from the view that modern filtration practices actually eliminate the water borne diseases, or typhoid fever and allied disorders at the very least. That is to say, where the plants are properly designed, well constructed, and intelligently operated, water filtration in practical terms is one hundred per cent hygienically efficient.

In Table 17 and Plate VIII some instructive statistics are presented to show how the urban typhoid fever death rate has been reduced as water filtration developed. The relationship between the two is strikingly proportional, and holds out every good promise for the future.

TABLE 17

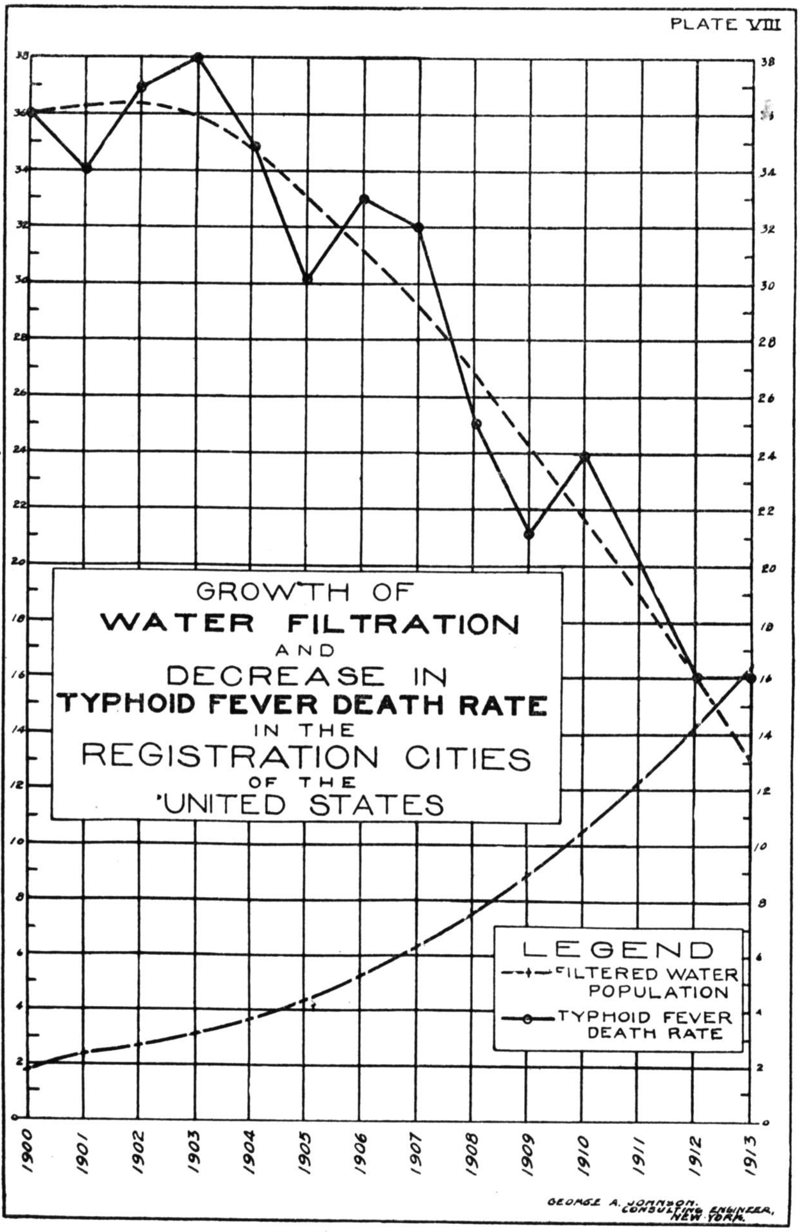
*Relationship between the increase in population supplied with filtered water and the decrease in the typhoid fever death rate in the registration cities of the United States*

| YEAR | POPULATIONS | | PER CENT WHICH FILTERED WATER POPULATION WAS OF | | |
|---|---|---|---|---|---|
| | Total for registration cities | Total in United States supplied with filtered water | Total population of United States | Total population registration cities | **Typhoid fever death rate in registration cities** |
| 1900 | 21,477,000 | 1,860,000 | 2.4 | 8.7 | **36** |
| 1 | 22,146,000 | 2,400,000 | 3.1 | 10.8 | **34** |
| 2 | 22,679,000 | 2,700,000 | 3.4 | 11.9 | **37** |
| 3 | 23,221,000 | 3,100,000 | 3.8 | 13.3 | **38** |
| 4 | 23,724,000 | 3,800,000 | 4.6 | 16.0 | **35** |
| 5 | 24,729,000 | 4,300,000 | 5.1 | 17.4 | **30** |
| 6 | 26,342,000 | 5,400,000 | 6.7 | 20.5 | **33** |
| 7 | 27,145,000 | 6,300,000 | 7.2 | 23.2 | **32** |
| 8 | 28,501,000 | 7,500,000 | 8.4 | 23.3 | **25** |
| 9 | 29,655,000 | 8,900,000 | 9.8 | 30.1 | **21** |
| 1910 | 21,342,000 | 10,805,000 | 11.7 | 34.6 | **24** |
| 11 | 32,376,000 | 12,000,000 | 12.8 | 37.2 | **20** |
| 12 | 33,304,000 | 14,100,000 | 14.7 | 42.4 | **16** |
| 13 | 34,230,000 | 16,500,000 | 17.0 | 48.0 | **16** |

## URBAN TYPHOID FEVER DEATH RATE IN THE UNITED STATES

In Table 18 all the available data are brought together in condensed form to show the average typhoid fever death rate among the urban population of the United States.

PLATE VIII



GROWTH OF
**WATER FILTRATION**
AND
DECREASE IN
**TYPHOID FEVER DEATH RATE**
IN THE
REGISTRATION CITIES
OF THE
UNITED STATES

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TABLE 18

*Semi-final analysis of the urban typhoid fever death rate in the United States*

| YEAR | REGISTRATION CITIES OF THE UNITED STATES | TOTAL SUPPLIED WITH FILTERED WATER | TOTAL FOR TWENTY REPRESENTATIVE CITIES WHICH ULTIMATELY ADOPTED FILTRATION | BALANCE IN REGISTRATION CITIES HAVING NO FILTRATION |
|---|---|---|---|---|
| | | *populations* | | |
| 1900 | 21,477,000 | 1,860,000 | 4,038,000 | 19,617,000 |
| 1913 | 34,230,000 | 16,500,000 | 5,364,000 | 17,730,000 |
| | | Typhoid fever death rate | | |
| 1900 | 36 | 42 | 49 | 37 |
| 1913 | 17 | 14* | 16 | 19 |
| | | Per cent reduction in typhoid death rate | | |
| Between 1910 and 1913 | 53 | 67* | 67 | 50 |

* Based upon actual experience noted in the case of the twenty representative cities.

The typhoid fever death rates in the southern states are uniformly higher than in the northern states. Reliable statistics are lacking from the former, and it is therefore difficult to estimate with accuracy the typhoid fever death rate in the country as a whole. In six of the nonregistration southern states, however, statistics are available from fourteen cities, with a total estimated population in 1913 of 1,444,000, and these are presented in Table 19.

TABLE 19

*Typhoid fever death rates in registration cities in southern non-registration states in the year 1913*

| STATE | TOTAL POPULATION OF REGISTRATION CITIES | TYPHOID FEVER DEATH RATE IN REGISTRATION CITIES | ESTIMATED TOTAL URBAN POPULATION IN STATE |
|---|---|---|---|
| Alabama | 254,000 | 39.4 | 1,100,000 |
| Georgia | 290,000 | 27.2 | 1,400,000 |
| Louisiana | 356,000 | 16.9 | 900,000 |
| South Carolina | 60,000 | 51.8 | 800,000 |
| Tennessee | 287,000 | 35.4 | 1,100,000 |
| Texas | 197,000 | 26.4 | 2,000,000 |
| Totals and weighted averages | 1,444,000 | 29.3 | 7,300,000 |

These data show that in 1913 the average typhoid fever death rate in these fourteen southern cities was 29.3 per 100,000 population, and in these six nonregistation states the estimated total urban population in 1913 was 7,300,000. We have already included the data for these fourteen cities in our figures given in Table 18, as showing the typhoid fever death rate in the registration cities of the United States, but by applying their average rate to the remainder of the urban population in these six nonregistration states, we may summarize as follows:

*Summary to show the average typhoid fever death rate among the total urban population of the United States (all figures based on conditions in 1913)*

| | URBAN POPULATION | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION |
|---|---|---|
| All registration cities | 34,230,000 | 17 |
| Balance in the six non-registration states | 5,856,000 | 29 |
| Balance in the United States | 10,000,000 | 23 |
| Weighted average | | 20 |

## WHAT THE COMMON PURIFICATION OF PUBLIC WATER SUPPLIES WOULD DO

If all the urban population of the United States were supplied with filtered water or water of equal purity, the average urban typhoid fever death rate would be fourteen per 100,000. In making this important statement it is well to explain that this figure was obtained by estimating, on a basis of proportions, an average typhoid fever death rate of forty-three per 100,000 among the total urban population of the United States in 1900, or about the time when filtration began to show its effects on the public health of the country. A reduction of 67 per cent in the typhoid rate immediately following filtration has been amply demonstrated. Hence a residual rate of fourteen per 100,000 results.

It has just been shown that the average typhoid fever death rate among the total urban population of the United States in 1913 was twenty per 100,000, a fair figure for present day conditions. Purer filtered water supplies, or supplies of equal purity, would lower this rate to fourteen, representing among the urban population a saving of 3000 lives annually, and forty-five thousand cases of typhoid fever. This represents an amount of vital capital equal to $22,500,000 annually, or, at 6 per cent, the interest on an investment of $375,000,000.

Of the 50,000,000 people representing the urban population of the United States, 20,000,000 are now supplied with filtered water. To build filtration works having a total daily capacity of 4000 million gallons daily, easily sufficient to provide pure water for the remaining 30,000,000 people, would not cost $100,000,000. To operate these works and pay all charges, including interest and sinking fund, would not cost more than $12,000,000 per year, or about one-half the present annual loss in vital capital. The remaining $10,500,000 per year in saved vital capital would make a substantial nucleus for a public health fund to be expended in general disease prevention work. It would represent 21 cents per capita per year for the entire urban population of the United States, and if expended solely for typhoid prevention would go a long way toward effecting the elimination of this plague.

In addition it must not be forgotten that the filtration of the water supplies of all the urban population of the country would reflect favorably on the health tone of the rural population, or such of it as comes in touch with the larger communities through periodical visits. This benefit is not measurable in precise figures, but what pure water in one city may mean to the health of a nearby community was never better demonstrated than in the case of Allegheny and Pittsburgh. They always were practically one city, and now are so incorporated. Allegheny has only quite recently received pure water from the Aspinwall filter plant, but as soon as filtered water was supplied to Pittsburgh the typhoid fever death rate in Allegheny, for no other apparent reason, began to decrease. For the three year periods before and after filtration of of the water supply of Pittsburgh, the average typhoid fever death rates in Allegheny, located just across the river, were ninety-one and thirty-six per 100,000 population, respectively. This was a reduction of 60 per cent, obviously due to the large number of the residents of Allegheny working in Pittsburgh and drinking the pure filtered water of that city.

## CONCLUSIONS

We are told by physiologists that in all mammals except man the span of life is five times the period of growth. Primitive man, who lived before the day of physiologists, doubtless existed much as other mammals, and, judging from the Holy Writ, and assuming that a biblical year represented one complete revolution of the earth around the sun, must have been cleverer than the other mammals in fending off the reaper of life.

It was not so long ago that we read of the compassionate methods of the Patagonians in dealing with old age, it appearing to be the custom to lean a stout club against the domicile of one who had lived beyond his usefulness, the inference thus being made plain. Descendants of our North American aborigines quite often claim an age in excess of five score years, although such examples are fast disappearing before the vitiating influences of modern civilization.

It seems to be quite true that the higher the plane of civilization the greater the untoward effects of insanitary living. The great plagues of ancient, medieval and modern times gathered their harvest of lives alike from rich and poor, just and unjust, clean and unclean. The susceptibility to cholera and typhoid fever of a person who bathes every day appears to be just as great as in a person whose ablutions occur at far less frequent intervals.

And yet, a man who follows the practice of daily bathing is not likely to have really unclean habits, nor his hands serve as shelters for disease germs. Distinctly dirty people, however, in a measure, seem to become immune to some forms of disease, and often pass their lives unharmed in the midst of filthy conditions, which would spell prompt infection to those of a higher order of intelligence if transplanted to such an environment.

The rapid promotion of ideal methods of living is not possible. It can only be effected by a slow transitional advancement. Custom is hard to uproot, and probably the greatest obstacles are presented where the democratic form of government prevails. Liberty and freedom are often misinterpreted to mean excess, and the exercise of self-emolumentalization at the expense of others. True sanitation is that which benefits, not a single individual or a community, but the public at large. A city may pompously declaim the possession of a modern system of water purification at its front door, and at its back door be fouling the water supply of its neighbor with its sewage. It has done for itself, taking no heed of its neighbors' welfare. "Sufficient unto the day" is its motto.

Individual freedom is measured by the control which governs personal convenience and desire. Attainment is measured by sacrifice and restraint. An individual or a city has no more moral or legal right deliberately to pollute a public water supply than deliberately to commit homicide. Typhoid fever accounts for twenty thousand lives each year in America largely through a misconceived idea of what constitutes personal liberty. Granting that the pollution of public waters cannot be entirely prevented, obviously it is the duty of every city to make pure such waters before they are delivered to the consumers. This is preparedness quite as important as preparedness for war. It is a measure of protection against disease and death, just as preparedness for war is protection against loss of life and property.

The greatest need of a nation for its own betterment is not so much more laws, as the rigid enforcement of laws already existing. If the wide array of laws against the pollution of public waters were enforced, grossly offensive conditions would never exist. If laws were enforced making it an imprisonable offence on the part of the officials of a city to allow the use of a contaminated water, or the existence of privies and cesspools, or slack garbage collection and disposal, or unclean streets and gutters, the health tone of the country at large would be immeasurably improved. It would cost money, and it would place restraints upon the individual citizen which at first would be resented, but a generation of such training would result in the complacent observance of the new order of affairs. If every public spirited citizen could be made to realize that liberty does not mean license to injure another for the sake of his own conveniences, and if he would understand that human happiness is based on the precept that the greatest good is that which conveys the greatest benefit to the greatest number, he would break away from his shell of custom, bigotry and selfish concern, and work for the general good of mankind. That is true liberty, true religion and true citizenship.

| CITY | STATE | POPULATION |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | 1880 | 1890 | 1900 | 1910 | 1915 (Est.) | 1880 | 1881 | 1882 | 1883 | 1884 | 1885 | 1886 | 1887 |
| Albany | N. Y. | 30,800 | 94,900 | 94,200 | 100,250 | 110,000 |  |  |  |  | 91 | 115 | 180 | 128 |
| Allegheny | Pa. | 78,600 | 105,300 | 130,000 | 150.000 | * | 56 | 122 | 140 | 72 | 47 | 72 | 63 | 116 |
| Atlanta | Ga. | 37,400 | 65,500 | 89,900 | 154,800 | 200,000 | 67 | 173 | 129 | 184 | 112 | 86 | 58 | 127 |
| Baltimore | Md. | 332,300 | 434,400 | 509,000 | 558,800 | 583,000 | 59 | 57 | 47 | 7 | 41 | 41 | 38 | 39 |
| Birmingham | Ala. |  |  |  | 132,700 | 180,000 |  |  |  |  |  |  |  |  |
| Boston | Mass. | 362,800 | 448,500 | 560,900 | 680,600 | 746,900 | 42 | 56 | 57 | 52 | 56 | 39 | 34 | 44 |
| Bridgeport | Conn. | 27,600 | 48,900 | 71,000 | 102,100 | 115,000 | 36 | 45 | 30 | 6 | 33 | 34 | 0 | 43 |
| Buffalo | N. Y. | 155,100 | 255,700 | 352,400 | 423,700 | 460,000 |  | 68 | 71 | 35 | 43 | 23 | 29 | 35 |
| Cambridge | Mass. | 52,700 | 70,000 | 91,900 | 104,800 | 112,000 | 19 | 39 | 31 | 28 | 41 | 27 | 34 | 32 |
| Camden | N. J. | 41,700 | 58,300 | 75,900 | 94,500 | 105,000 | 60 | 75 | 114 | 86 | 73 | 89 | 82 | 96 |
| Charleston | S. C. | 50,000 | 55,000 | 55,800 | 58,800 | 72,000 | 112 | 113 | 105 | 110 | 83 | 56 | 66 | 81 |
| Chicago | Ill. | 503,200 | 1,099,900 | 1,698,600 | 2,185,300 | 2,437,500 | 34 | 101 | 75 | 53 | 48 | 62 | 56 | 41 |
| Cincinnati | Ohio | 255,100 | 296,900 | 325,900 | 363,600 | 400,000 | 70 | 71 | 56 | 51 | 56 | 42 | 54 | 142 |
| Cleveland | Ohio | 160,100 | 261,400 | 381,800 | 560,700 | 720,000 | 44 | 99 | 68 | 65 | 60 | 34 | 51 | 52 |
| Columbus | Ohio | 51,600 | 88,100 | 125,600 | 181,500 | 207,000 |  |  |  |  |  |  |  |  |
| Dayton | Ohio | 38,700 | 61,200 | 85,300 | 116,600 | 130,000 | 36 | 92 | 29 | 41 | 42 | 42 | 35 | 35 |
| Denver | Col. | 35,600 | 106,700 | 133,900 | 213,400 | 235,000 |  |  |  |  |  |  |  | 141 |
| Des Moines | Iowa | 22,400 | 50,100 | 62,100 | 86,400 | 100,000 |  |  |  |  |  |  |  |  |
| Detroit | Mich | 116,300 | 205,900 | 285,700 | 465,800 | 600,000 |  |  | 54 | 50 | 58 | 49 | 39 | 65 |
| Duluth | Minn. | 800 | 33,100 | 53,000 | 78,400 | 92,000 |  |  |  |  |  |  |  |  |
| Elizabeth | N. J. | 28,200 | 37,800 | 52,100 | 73,400 | 81,400 | 21 | 28 | 24 | 43 | 41 | 31 | 27 | 20 |
| Erie | Pa. | 27,700 | 40,600 | 52,700 | 66,500 | 80,000 | 14 | 59 | 64 | 20 | 19 | 31 | 32 | 20 |
| Evansville | Ind. | 29,300 | 50,800 | 59,000 | 69,600 | 92,500 |  |  |  |  |  |  |  | 85 |
| Fall River | Mass. | 49,000 | 74,400 | 104,900 | 119,300 | 122,600 | 71 | 63 | 97 | 60 | 46 | 54 | 49 | 70 |
| Grand Rapids | Mich. | 32,000 | 60,200 | 87,600 | 112,600 | 125,000 |  |  |  |  |  |  |  |  |
| Harrisburg | Pa. | 30,800 | 39,400 | 50,200 | 64,200 | 75,000 |  |  |  |  |  |  |  |  |
| Hartford | Conn. | 42,000 | 53,200 | 79,800 | 93,900 | 125,000 | 31 | 63 | 68 | 28 | 61 | 45 | 44 | 16 |
| Hoboken | N. J. | 31,000 | 43,600 | 59,400 | 70,300 | 75,000 | 25 | 22 | 82 | 41 | 69 | 58 | 54 | 42 |
| Indianapolis | Ind. | 75,100 | 105,400 | 169,200 | 233,700 | 270,000 |  |  |  |  |  |  |  |  |
| Jersey City | N. J. | 120,700 | 163,000 | 206,400 | 267,800 | 300,900 | 26 | 63 | 121 | 49 | 85 | 71 | 61 | 54 |
| Kansas City | Kas. | 3,200 | 38,300 | 51,400 | 82,300 | 100,000 |  |  |  |  |  |  |  |  |
| Kansas City | Mo. | 55,200 | 132,700 | 163,800 | 248,400 | 300,000 |  |  |  |  |  |  |  |  |
| Lawrence | Mass. | 39,200 | 44,700 | 62,600 | 85,900 | 90,000 | 69 | 124 | 77 | 69 | 46 | 41 | 55 | 110 |
| Los Angeles | Cal. | 11,200 | 50,400 | 102,400 | 319,200 | 550,000 |  |  |  |  | 89 |  |  | 127 |
| Louisville | Ky. | 123,200 | 161,100 | 204,700 | 223,900 | 235,000 | 66 | 107 | 92 | 44 | 114 | 109 | 81 | 81 |
| Lowell | Mass. | 59,500 | 77,700 | 95,000 | 106,300 | 111,000 | 37 | 86 | 80 | 76 | 62 | 72 | 72 | 125 |
| Lynn | Mass. | 38,300 | 55,700 | 68,500 | 89,300 | 96,000 | 68 | 60 | 65 | 49 | 45 | 30 | 29 | 32 |
| Manchester | N. H. | 32,600 | 44,100 | 57,000 | 70,100 | 80,000 |  |  | 155 | 64 | 53 | 58 | 32 | 48 |
| Memphis | Tenn. | 33,600 | 64,500 | 102,300 | 131,100 | 146,000 |  |  |  | 59 | 87 | 62 | 70 | 78 |
| Milwaukee | Wis. | 115,600 | 204,500 | 285,300 | 373,900 | 418,900 | 37 | 47 | 31 | 24 | 30 | 27 | 29 | 30 |
| Minneapolis | Minn. | 46,900 | 164,700 | 202,700 | 301,400 | 355,000 |  |  |  |  |  |  |  |  |
| Nashville | Tenn. | 44,300 | 71,200 | 80,900 | 101,400 | 121,000 | 133 | 84 | 57 | 63 | 83 | 65 | 39 | 52 |
| Newark | N. J. | 136,500 | 181,100 | 246,100 | 347,500 | 405,000 | 53 | 36 | 66 | 59 | 55 | 58 | 51 | 49 |
| New Bedford | Mass. | 26,800 | 40,800 | 62,400 | 96,700 | 110,000 | 7 | 43 | 42 | 33 | 73 | 21 | 79 | 17 |
| New Haven | Conn. | 62,900 | 81,300 | 108,000 | 133,600 | 145,000 | 29 | 37 | 36 | 49 | 60 | 24 | 34 | 31 |
| New Orleans | La. | 216,100 | 242,400 | 287,100 | 339,100 | 400,000 |  | 30 | 33 | 23 | 25 | 16 | 13 | 14 |
| New York | N. Y. | 1,897,700 | 2,487,800 | 3,437,200 | 4,766,900 | 5,625,000 | 23 | 36 | 31 | 35 | 28 | 26 | 25 | 25 |
| Oakland | Cal. | 34,600 | 48,700 | 67,000 | 150,200 | 225,000 | 58 |  |  |  | 32 | 30 | 31 | 35 |
| Omaha | Neb. | 30,518 | 140,500 | 102,600 | 124,100 | 155,000 |  |  |  |  |  |  |  |  |
| Paterson | N. J. | 51,000 | 78,300 | 105,200 | 125,600 | 34,500 |  |  |  |  |  | 28 | 28 | 24 |
| Peoria | Ill. | 29,300 | 41,000 | 56,000 | 66,900 | 74,000 |  |  |  |  |  |  |  |  |
| Philadelphia | Pa. | 847,200 | 1,047,000 | 1,293,700 | 1,549,000 | 1,700,000 | 59 | 74 | 73 | 64 | 71 | 64 | 64 | 63 |
| Pittsburgh | Pa. | 156,400 | 238,600 | 321,600 | 533,900 | 600,000 | 136 | 152 | 156 | 105 | 69 | 78 | 68 | 125 |
| Portland | Me. | 33,800 | 36,400 | 50,100 | 58,600 | 63,000 |  |  |  |  |  |  |  | 8 |
| Portland | Ore. | 17,600 | 46,400 | 90,400 | 207,200 | 277,200 |  |  |  |  |  |  |  |  |
| Providence | R. I. | 104,900 | 132,100 | 175,600 | 224,300 | 247,700 | 50 | 36 | 128 | 115 | 46 | 38 | 45 | 33 |
| Reading | Pa. | 44,300 | 58,700 | 79,000 | 96,100 | 103,000 | 49 | 80 | 52 | 38 | 32 | 28 | 42 | 35 |
| Richmond | Va. | 63,600 | 81,400 | 85,000 | 127,600 | 155,000 | 61 | 110 | 78 | 77 | 176 | 73 | 38 | 44 |
| Rochester | N. Y. | 89,400 | 133,900 | 162,600 | 218,100 | 245,000 | 23 | 28 | 31 | 40 | 48 | 30 | 29 | 32 |
| St. Louis | Mo. | 350,500 | 451,800 | 575,200 | 678,000 | 750,000 | 40 | 58 | 45 | 41 | 42 | 31 | 30 | 28 |
| St. Paul | Minn. | 41,500 | 133,200 | 163,100 | 214,700 | 275,000 | 87 | 200 | 160 | 105 | 116 | 55 | 73 | 141 |
| San Antonio | Tex. | 20,600 | 37,700 | 53,300 | 96,600 | 120,000 | 72 | 103 | 104 | 198 | 156 | 99 | 83 | 85 |
| San Francisco | Cal. | 234,000 | 299,000 | 342,800 | 416,900 | 500,000 | 36 | 38 | 62 | 65 | 58 | 44 | 50 | 23 |
| Savannah | Ga. | 30,700 | 43,200 | 54,200 | 65,100 | 85,000 |  |  |  |  |  |  |  |  |
| Scranton | Pa. | 45,800 | 72,200 | 102,000 | 129,900 | 160,000 | 26 | 43 | 25 | 54 | 51 | 67 | 34 | 18 |
| Seattle | Wash. | 3,500 | 42,800 | 80,700 | 237,200 | 310,000 |  |  |  |  |  |  |  |  |
| Somerville | Mass. | 24,900 | 40,200 | 61,600 | 77,200 | 83,000 | 28 | 31 | 30 | 46 | 27 | 36 | 9 | 33 |
| Spokane | Wash. |  |  |  | 104,400 | 120,000 |  |  |  |  |  |  |  |  |
| Springfield | Mass. | 33,300 | 44,200 | 62,100 | 88,900 | 105,000 | 48 | 79 | 63 | 78 | 49 | 58 | 31 | 42 |
| St. Joseph | Mo. | 32,400 | 52,300 | 63,000 | 77,400 | 85,000 |  |  |  |  |  |  |  |  |
| Syracuse | N. Y. | 51,800 | 88,100 | 108,400 | 137,200 | 155,000 |  |  |  |  | 19 | 22 | 35 | 28 |
| Toledo | Ohio | 50,100 | 81,400 | 131,800 | 168,500 | 187,000 | 36 | 41 |  | 36 |  | 26 | 14 | 34 |
| Trenton | N. J. | 29,100 | 57,500 | 73,300 | 96,800 | 104,000 | 17 | 62 | 62 | 47 | 59 | 29 | 30 | 40 |
| Troy | N. Y. | 56,700 | 61,000 | 61,000 | 76,800 | 80,000 |  |  |  |  | 21 | 60 | 82 | 82 |
| Utica | N. Y. | 33,900 | 44,000 | 56,400 | 74,400 | 86,000 | 50 | 31 | 39 | 24 | 24 | 26 | 26 | 32 |
| Washington | D. C. | 177,600 | 230,400 | 278,700 | 331,100 | 355,000 | 53 | 84 | 65 | 61 | 77 | 66 | 73 | 78 |
| Wilkes-Barre | Pa. | 23,300 | 37,700 | 51,700 | 67,100 | 74,000 |  |  |  |  |  |  |  |  |
| Wilmington | Del. | 42,500 | 61,400 | 76,500 | 87,400 | 100,000 | 57 | 100 | 116 | 70 | 96 | 51 | 49 | 69 |
| Worcester | Mass. | 58,300 | 84,700 | 118,400 | 146,000 | 170,000 | 53 | 35 | 45 | 28 | 30 | 28 | 7 | 18 |

* Included in Greater Pittsburgh.

# APPENDIX

## TABLE 20

*Typhoid fever death rates in large American cities*

| TYPHOID FEVER DEATH RATE PER 100,000 POPULA | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1883 | 1884 | 1885 | 1886 | 1887 | 1888 | 1889 | 1890 | 1891 | 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 |
| | 91 | 115 | 180 | 128 | 114 | 100 | 65 | 113 | 52 | 61 | 55 | 170 | 102 | 88 | 100 | 87 | 51 | 21 | 32 | 20 | 18 | 19 | 20 | 20 |
| 72 | 47 | 72 | 63 | 116 | 107 | 104 | 139 | 90 | 157 | 145 | 88 | 196 | 50 | 65 | 56 | 105 | 93 | 75 | 122 | 123 | 123 | 127 | 136 | 97 |
| 184 | 112 | 86 | 58 | 127 | 186 | 79 | 152 | 119 | 107 | 89 | 68 | 90 | 88 | 69 | 62 | 86 | 61 | 77 | 69 | 66 | 61 | 70 | 50 | 64 |
| 7 | 41 | 41 | 38 | 39 | 39 | 45 | 57 | 34 | 43 | 49 | 48 | 37 | 40 | 39 | 37 | 30 | 37 | 29 | 42 | 35 | 37 | 36 | 34 | 41 |
| | | | | | | | | | | | | | | | | | | | | | | | 39 | 71 |
| 52 | 56 | 39 | 34 | 44 | 40 | 43 | 35 | 34 | 29 | 31 | 29 | 32 | 31 | 33 | 34 | 30 | 26 | 25 | 24 | 21 | 23 | 20 | 22 | 10 |
| 6 | 33 | 34 | 0 | 43 | 19 | 18 | 6 | 16 | 13 | 22 | 3 | 10 | 18 | 23 | 10 | 11 | 21 | 26 | 24 | 14 | 17 | 13 | 10 | 13 |
| 35 | 43 | 23 | 29 | 35 | 29 | 30 | 41 | 49 | 36 | 40 | 63 | 29 | 22 | 21 | 28 | 25 | 27 | 27 | 34 | 35 | 24 | 24 | 24 | 29 |
| 28 | 41 | 27 | 34 | 32 | 41 | 37 | 24 | 22 | 21 | 22 | 36 | 15 | 37 | 13 | 15 | 22 | 16 | 9 | 11 | 11 | 16 | 12 | 18 | 10 |
| 86 | 73 | 89 | 82 | 96 | 102 | 161 | 141 | 55 | 62 | 61 | 65 | 97 | 47 | 55 | 43 | 38 | 16 | 16 | 23 | 14 | 21 | 18 | 18 | 22 |
| 110 | 83 | 56 | 66 | 81 | 56 | 74 | 102 | 51 | 49 | 44 | 44 | 60 | 80 | 72 | 131 | 109 | 127 | 86 | 80 | 64 | 59 | 53 | 84 | 50 |
| 53 | 48 | 62 | 56 | 41 | 38 | 44 | 92 | 172 | 122 | 58 | 37 | 38 | 52 | 29 | 38 | 26 | 20 | 30 | 45 | 32 | 20 | 17 | 18 | 18 |
| 51 | 56 | 42 | 54 | 142 | 71 | 49 | 69 | 62 | 40 | 44 | 55 | 39 | 52 | 32 | 36 | 37 | 37 | 55 | 62 | 43 | 80 | 41 | 71 | 46 |
| 65 | 60 | 34 | 51 | 52 | 47 | 74 | 69 | 50 | 59 | 52 | 29 | 36 | 43 | 23 | 32 | 29 | 54 | 35 | 36 | 115 | 50 | 15 | 20 | 19 |
| | | | | | | 44 | 74 | 53 | 47 | 46 | 45 | 52 | 44 | 25 | 26 | 22 | 42 | 48 | 37 | 38 | 148 | 85 | 45 | 38 |
| 41 | 42 | 42 | 35 | 35 | 28 | 31 | 20 | 30 | 43 | 69 | 73 | 81 | 64 | 24 | 21 | 36 | 31 | 34 | 44 | 24 | 27 | 22 | 28 | 38 |
| | | | | 141 | 161 | 188 | 268 | 90 | 57 | 62 | 51 | 36 | 75 | 50 | 31 | 38 | 42 | 49 | 61 | 56 | 30 | 41 | 68 | 67 |
| | | | | | | | | | | 41 | 53 | 54 | 25 | 34 | | | | | | | | 18 | 16 | 16 |
| 50 | 58 | 49 | 39 | 65 | 46 | 32 | 19 | 34 | 94 | 42 | 28 | 23 | 22 | 15 | 17 | 19 | 18 | 21 | 23 | 20 | 18 | 21 | 22 | 28 |
| | | | | | 280 | 158 | 126 | 208 | 116 | 144 | 181 | 250 | 267 | 96 | 49 | 38 | 94 | 74 | 54 | 65 | 54 | 45 | 46 | 41 |
| 43 | 41 | 31 | 27 | 20 | 34 | 24 | 53 | 13 | 27 | 19 | 24 | 32 | 18 | 15 | 13 | 17 | 8 | 28 | 27 | 21 | 19 | 8 | 17 | 14 |
| 20 | 19 | 31 | 32 | 20 | 24 | 51 | 71 | 72 | 57 | 35 | 38 | 46 | 41 | 27 | 13 | 34 | 34 | 17 | 25 | 34 | 49 | 17 | 47 | 77 |
| | | | | 85 | 66 | 71 | 77 | 100 | 56 | 67 | 64 | 178 | 49 | 28 | 48 | 66 | 63 | 27 | 43 | 28 | 40 | 43 | 38 | 34 |
| 60 | 46 | 54 | 49 | 70 | 68 | 68 | 280 | 64 | 34 | 76 | 39 | 34 | 27 | 33 | 20 | 11 | 14 | 26 | 11 | 23 | 11 | 11 | 8 | 18 |
| | | | | | | | 50 | 69 | 81 | 105 | 52 | 46 | 12 | 18 | 32 | 30 | 42 | 36 | 51 | 42 | 62 | 49 | 39 | 30 |
| | | | | | | | 76 | 107 | 76 | 110 | 70 | 57 | 20 | 17 | 32 | 40 | 48 | 66 | 63 | 104 | 59 | 69 | 66 | 48 |
| 28 | 61 | 45 | 44 | 16 | 51 | 50 | 56 | 71 | 81 | 48 | 52 | 57 | 46 | 29 | 45 | 48 | 44 | 44 | 16 | 22 | 13 | 17 | 33 | 19 |
| 41 | 69 | 58 | 54 | 42 | 38 | 58 | 44 | 31 | 33 | 21 | 35 | 22 | 41 | 17 | 14 | 30 | 17 | 26 | 10 | 16 | 20 | 14 | 17 | 27 |
| | | | | | | | | | 44 | 89 | 43 | 101 | 56 | 43 | 28 | 38 | 44 | 33 | 45 | 51 | 68 | 30 | 39 | 29 |
| 49 | 85 | 71 | 61 | 54 | 74 | 83 | 98 | 100 | 72 | 66 | 54 | 95 | 85 | 20 | 34 | 15 | 21 | 16 | 20 | 15 | 19 | 20 | 20 | 14 |
| | | | | | | | | | 17 | 30 | 23 | 29 | 17 | 19 | 32 | 33 | 52 | 58 | 62 | 88 | 65 | 75 | 56 | 91 |
| | | | | | | | | | | | | | | | 25 | 31 | 36 | 46 | 38 | 80 | 43 | 61 | 38 | 40 |
| 69 | 46 | 41 | 55 | 110 | 111 | 125 | 154 | 120 | 127 | 103 | 48 | 31 | 19 | 16 | 18 | 32 | 22 | 19 | 20 | 28 | 18 | 23 | 20 | 30 |
| | 89 | | | 127 | 119 | 100 | 38 | 52 | 38 | 59 | 65 | 43 | 36 | 29 | | | | | | | | | 18 | 23 |
| 44 | 114 | 109 | 81 | 81 | 88 | 92 | 83 | 79 | 69 | 78 | 82 | 69 | 70 | 48 | 58 | 60 | 58 | 46 | 60 | 60 | 62 | 49 | 68 | 79 |
| 76 | 62 | 72 | 72 | 125 | 79 | 91 | 161 | 98 | 95 | 67 | 60 | 38 | 43 | 19 | 26 | 18 | 18 | 20 | 18 | 33 | 20 | 19 | 7 | 9 |
| 49 | 45 | 30 | 29 | 32 | 23 | 12 | 19 | 19 | 18 | 19 | 19 | 20 | 41 | 28 | 22 | 19 | 19 | 14 | 13 | 18 | 24 | 23 | 15 | 17 |
| 64 | 53 | 58 | 32 | 48 | 30 | 38 | 38 | 39 | 23 | 31 | 42 | 41 | 38 | 20 | 25 | 21 | 11 | 17 | 15 | 18 | 21 | 19 | 14 | 14 |
| 59 | 87 | 62 | 70 | 78 | 77 | 59 | 54 | 68 | 30 | 31 | 55 | 42 | 40 | 34 | 22 | 38 | 35 | 52 | 39 | 41 | 46 | 34 | 42 | 35 |
| 24 | 30 | 27 | 29 | 30 | 40 | 27 | 40 | 32 | 29 | 34 | 25 | 25 | 18 | 12 | 16 | 17 | 21 | 22 | 15 | 17 | 14 | 23 | 30 | 26 |
| | | | | | 127 | 76 | 39 | 59 | 49 | 82 | 56 | 47 | 36 | 81 | 42 | 35 | 39 | 59 | 27 | 41 | 40 | 24 | 33 | 26 |
| 63 | 83 | 65 | 39 | 52 | 62 | 64 | 50 | 63 | 59 | 49 | 38 | 55 | 44 | 59 | 27 | 62 | 48 | 43 | 51 | 70 | 55 | 71 | 74 | 85 |
| 59 | 55 | 58 | 51 | 49 | 43 | 73 | 107 | 71 | 77 | 31 | 20 | 19 | 27 | 19 | 17 | 27 | 20 | 24 | 20 | 23 | 14 | 14 | 18 | 24 |
| 33 | 73 | 21 | 79 | 17 | 21 | 47 | 13 | 19 | 38 | 63 | 27 | 18 | 27 | 42 | 27 | 26 | 35 | 31 | 36 | 50 | 21 | 8 | 10 | 13 |
| 49 | 60 | 24 | 34 | 31 | 48 | 30 | 29 | 22 | 30 | 32 | 31 | 35 | 29 | 26 | 36 | 26 | 26 | 94 | 39 | 37 | 27 | 43 | 54 | 30 |
| 23 | 25 | 16 | 13 | 14 | 19 | 17 | 21 | 24 | 20 | 15 | 28 | 41 | 32 | 50 | 64 | 54 | 40 | 50 | 44 | 41 | 37 | 33 | 30 | 56 |
| 35 | 28 | 26 | 25 | 25 | 22 | 23 | 22 | 23 | 22 | 21 | 18 | 18 | 16 | 16 | 21 | 16 | 21 | 21 | 20 | 17 | 17 | 16 | 15 | 17 |
| | 32 | 30 | 31 | 35 | 47 | 39 | 45 | 54 | 39 | 89 | 25 | 30 | 29 | 14 | 13 | 36 | 20 | 12 | 23 | 21 | 43 | 36 | 26 | 28 |
| | | | | | | | | 17 | 13 | 16 | 30 | 23 | 14 | 19 | 31 | 25 | 23 | 24 | 22 | 11 | 17 | 25 | 28 | 24 |
| | | 28 | 28 | 24 | 24 | 26 | 23 | 23 | 18 | 39 | 32 | 23 | 50 | 50 | 33 | 46 | 23 | 23 | 34 | 22 | 7 | 14 | 4 | 11 |
| 64 | 71 | 64 | 64 | 63 | 78 | 72 | 63 | 64 | 40 | 41 | 32 | 40 | 34 | 33 | 49 | 73 | 35 | 35 | 47 | 73 | 55 | 51 | 75 | 60 |
| 105 | 69 | 78 | 68 | 125 | 95 | 95 | 132 | 101 | 101 | 112 | 57 | 77 | 62 | 63 | 68 | 107 | 144 | 124 | 141 | 136 | 139 | 108 | 141 | 135 |
| | | | | 8 | 15 | 25 | 7 | 29 | 14 | 33 | 46 | 47 | 26 | 24 | 72 | 30 | 32 | 29 | 29 | 32 | 28 | 42 | 16 | 19 |
| | | | | | | | | | | | | | | | 22 | 23 | 27 | 21 | 36 | 36 | 26 | 35 | 25 | 22 |
| 115 | 46 | 38 | 45 | 33 | 84 | 47 | 30 | 46 | 37 | 35 | 47 | 30 | 25 | 15 | 22 | 24 | 23 | 25 | 21 | 20 | 15 | 20 | 19 | 8 |
| 38 | 32 | 28 | 42 | 35 | 45 | 45 | 55 | 48 | 45 | 39 | 51 | 54 | 52 | 34 | 65 | 33 | 50 | 53 | 66 | 32 | 33 | 26 | 40 | 47 |
| 77 | 176 | 73 | 38 | 44 | 39 | 55 | 93 | 60 | 74 | 61 | 35 | 35 | 15 | 24 | 31 | 44 | 88 | 52 | 72 | 73 | 54 | 45 | 47 | 41 |
| 40 | 48 | 30 | 29 | 32 | 44 | 30 | 32 | 37 | 51 | 41 | 12 | 29 | 17 | 23 | 14 | 18 | 19 | 17 | 12 | 12 | 16 | 12 | 17 | 16 |
| 41 | 42 | 31 | 30 | 28 | 30 | 32 | 30 | 37 | 106 | 34 | 33 | 19 | 22 | 21 | 17 | 23 | 29 | 33 | 40 | 52 | 38 | 23 | 18 | 16 |
| 105 | 116 | 55 | 73 | 141 | 119 | 82 | 56 | 48 | 41 | 42 | 26 | 28 | 29 | 16 | 26 | 18 | 22 | 14 | 14 | 10 | 14 | 11 | 21 | 17 |
| 198 | 156 | 99 | 83 | 85 | 107 | 72 | 114 | 84 | 78 | 54 | 100 | 76 | 31 | 30 | 35 | 43 | 90 | 62 | 65 | 62 | 50 | 44 | 29 | 51 |
| 65 | 58 | 44 | 50 | 23 | 33 | 55 | 44 | 42 | 32 | 32 | 38 | 34 | 26 | 19 | 17 | 51 | 41 | 25 | 30 | 25 | 31 | 24 | — | 57 |
| | | | | | | | | | | | | | | | 37 | 35 | 30 | 29 | 44 | 54 | 79 | 40 | 41 | 84 |
| 54 | 51 | 67 | 34 | 18 | 60 | 38 | 34 | 52 | 59 | 42 | 36 | 55 | 39 | 24 | 14 | 25 | 29 | 34 | 20 | 18 | 11 | 17 | 11 | 76 |
| | | | | | | | | | | | | | | | 30 | 31 | 30 | 31 | 33 | 37 | 37 | 36 | 20 | 48 |
| 46 | 27 | 36 | 9 | 33 | 48 | 19 | 122 | 31 | 32 | 29 | 28 | 21 | 51 | 21 | 18 | 24 | 15 | 19 | 8 | 14 | 18 | 13 | 14 | 17 |
| | | | | | | | | | | | | | | | 52 | 46 | 65 | 52 | 47 | 88 | 80 | 86 | 98 | 38 |
| 78 | 49 | 58 | 31 | 42 | 63 | 44 | 200 | 36 | 84 | 36 | 33 | 18 | 21 | 35 | 24 | 24 | 27 | 28 | 19 | 23 | 15 | 27 | 21 | 29 |
| | | | | | | | | | 29 | | 34 | 28 | 38 | 28 | 12 | 34 | 7 | 14 | 14 | 8 | 12 | 8 | 12 | 14 |
| | 19 | 22 | 35 | 28 | 35 | 27 | 33 | 45 | 36 | 37 | 43 | 32 | 31 | 24 | 43 | 18 | 29 | 19 | 8 | 18 | 18 | 17 | 10 | 16 |
| 36 | | 26 | 14 | 34 | 35 | 37 | 47 | 27 | 40 | 27 | 32 | 40 | 36 | 34 | 24 | 30 | 39 | 32 | 35 | 30 | 37 | 46 | 45 | 36 |
| 47 | 59 | 29 | 30 | 40 | 24 | 39 | 19 | 26 | 25 | 31 | 26 | 17 | 24 | 37 | 30 | 45 | 31 | 19 | 40 | 60 | 43 | 25 | 35 | 79 |
| | 21 | 60 | 82 | 82 | 57 | 76 | 41 | 79 | 44 | 61 | 57 | 64 | 46 | 33 | 73 | 76 | 155 | 57 | 49 | 36 | 50 | 51 | 34 | 28 |
| 24 | 24 | 26 | 26 | 32 | 17 | 28 | 25 | 24 | 44 | 11 | 25 | 16 | 18 | 15 | 21 | 18 | 25 | 16 | 17 | 18 | 18 | 13 | 27 | 19 |
| 61 | 77 | 66 | 73 | 78 | 86 | 95 | 112 | 80 | 91 | 84 | 89 | 94 | 58 | 50 | 61 | 61 | 78 | 61 | 79 | 49 | 47 | 48 | 52 | 36 |
| | | | | | | | | | | | | | | | | | | | | | | | 31 | 45 |
| 70 | 96 | 51 | 49 | 69 | 57 | 51 | 90 | 56 | 46 | 68 | 43 | 40 | 22 | 33 | 35 | 60 | 47 | 41 | 61 | 95 | 51 | 36 | 46 | 40 |
| 28 | 30 | 28 | 7 | 18 | 3 | 31 | 18 | 21 | 22 | 34 | 33 | 26 | 14 | 15 | 11 | 16 | 27 | 22 | 14 | 15 | 6 | 21 | 11 | 14 |

TE PER 100,000 POPULATION LIVING

| 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | Averages | | | | Per cent reduction | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | 1880 to 1889 | 1890 to 1899 | 1900 to 1909 | 1910 to 1913 | 1880-9 to 1890-9 | 1890-9 to 1900-9 | 1880-9 to 1900-9 | 1900-9 to 1910-13 |
| 20 | 18 | 19 | 20 | 20 | 11 | 19 | 15 | 18 | 18 | 27 | | 89 | 23 | 19 | | 74.2 | | 17.4 |
| 123 | 123 | 127 | 136 | 97 | 40 | 28 | 42 | 39 | * | * | 90 | 109 | 96 | * | +21.1 | 11.9 | +6.7 | — |
| 66 | 61 | 70 | 50 | 64 | 47 | 44 | 43 | 56 | 35 | 22 | 120 | 93 | 61 | 39 | 22.5 | 34.4 | 49.2 | 36.1 |
| 35 | 37 | 36 | 34 | 41 | 31 | 23 | 42 | 26 | 22 | 24 | 48 | 41 | 34 | 28 | 14.6 | 17.1 | 29.2 | 17.6 |
| | | | 39 | 71 | 64 | 44 | 51 | 44 | 38 | 36 | | | | 42 | | | | |
| 21 | 23 | 20 | 22 | 10 | 26 | 14 | 11 | 8 | 9 | 8 | 46 | 32 | 21 | 9 | 30.5 | 34.4 | 54.3 | 57.2 |
| 14 | 17 | 13 | 10 | 13 | 13 | 13 | 9 | 4 | 8 | 6 | 26 | 13 | 16 | 7 | 26.9 | +23.1 | 38.5 | 56.3 |
| 35 | 24 | 24 | 24 | 29 | 21 | 23 | 20 | 25 | 11 | 15 | 42 | 35 | 27 | 18 | 16.7 | 22.9 | 35.9 | 33.3 |
| 11 | 16 | 12 | 18 | 10 | 10 | 9 | 12 | 4 | 4 | 9 | 33 | 23 | 12 | 7 | 30.3 | 47.8 | 63.7 | 41.7 |
| 14 | 21 | 18 | 18 | 22 | 13 | 11 | 17 | 9 | 11 | 19 | 94 | 66 | 17 | 14 | 29.8 | 74.2 | 82.0 | 17.5 |
| 64 | 59 | 53 | 84 | 50 | 46 | 56 | 56 | 41 | 54 | 52 | 86 | 74 | 70 | 51 | 14.0 | 5.4 | 18.6 | 27.2 |
| 32 | 20 | 17 | 18 | 18 | 15 | 12 | 14 | 10 | 7 | 10 | 55 | 66 | 23 | 10 | +20.0 | 65.2 | 58.2 | 56.5 |
| 43 | 80 | 41 | 71 | 46 | 19 | 13 | 6 | 11 | 7 | 7 | 66 | 47 | 47 | 8 | 28.8 | 0.0 | 28.8 | 83.0 |
| 115 | 50 | 15 | 20 | 19 | 13 | 12 | 19 | 14 | 6 | 14 | 59 | 42 | 37 | 13 | 28.8 | 11.9 | 37.3 | 64.8 |
| 38 | 148 | 85 | 45 | 38 | 110 | 17 | 17 | 14 | 19 | 19 | | 43 | 61 | 17 | | +41.8 | | 71.2 |
| 24 | 27 | 22 | 28 | 38 | 16 | 24 | 18 | 18 | 17 | 18 | 41 | 46 | 29 | 18 | +12.2 | 27.1 | 29.3 | 37.9 |
| 56 | 30 | 41 | 68 | 67 | 58 | 24 | 28 | 17 | 13 | 14 | | 76 | 50 | 18 | | 34.2 | | 64.0 |
| | | 18 | 16 | 16 | 30 | 18 | 32 | 25 | 10 | 13 | | | | 20 | | | | |
| 20 | 18 | 21 | 22 | 28 | 22 | 19 | 20 | 16 | 19 | 29 | | 31 | 21 | 21 | | 32.3 | | 0.0 |
| 65 | 54 | 45 | 46 | 41 | 56 | 51 | 76 | 23 | 23 | 24 | | 147 | 58 | 36 | | 60.6 | | 38.3 |
| 21 | 19 | 8 | 17 | 14 | 23 | 20 | 19 | 8 | 15 | 14 | 29 | 23 | 18 | 14 | 20.7 | 21.7 | 38.0 | 22.2 |
| 34 | 49 | 17 | 47 | 77 | 61 | 29 | 39 | 191 | 12 | 17 | 33 | 43 | 39 | 65 | 30.3 | 9.3 | +18.2 | +66.7 |
| 28 | 40 | 43 | 38 | 34 | 34 | 39 | 33 | 21 | 35 | 44 | | 73 | 39 | 33 | | 46.7 | | 15.4 |
| 23 | 11 | 11 | 8 | 18 | 13 | 14 | 13 | 15 | 16 | 9 | 65 | 61 | 15 | 13 | 6.2 | 75.5 | 76.9 | 13.3 |
| 42 | 62 | 49 | 39 | 30 | 30 | 17 | 26 | 25 | 31 | 18 | | 49 | 40 | 25 | | 18.4 | | 37.5 |
| 104 | 59 | 69 | 66 | 48 | 50 | 29 | 33 | 17 | 13 | 16 | | 60 | 60 | 20 | | 0.0 | | 66.7 |
| 22 | 13 | 17 | 33 | 19 | 19 | 10 | 19 | 20 | 13 | 23 | 46 | 53 | 24 | 19 | 15.2 | 54.7 | 91.3 | 20.8 |
| 16 | 20 | 14 | 17 | 27 | 12 | 10 | 16 | 18 | 8 | 12 | 49 | 29 | 17 | 13 | 40.9 | 41.4 | 65.3 | 23.5 |
| 51 | 68 | 30 | 39 | 29 | 26 | 22 | 30 | 26 | 17 | 24 | | | 39 | 24 | | | | 38.4 |
| 15 | 19 | 20 | 20 | 14 | 10 | 8 | 12 | 8 | 8 | 11 | 69 | 55 | 16 | 10 | 20.3 | 71.0 | 76.8 | 37.5 |
| 88 | 65 | 75 | 56 | 91 | 53 | 75 | 95 | 59 | 29 | 29 | | | 67 | 53 | | | | 20.9 |
| 80 | 43 | 61 | 38 | 40 | 35 | 23 | 43 | 24 | 12 | 22 | | | 44 | 25 | | | | 43.2 |
| 28 | 18 | 23 | 20 | 30 | 24 | 22 | 16 | 12 | 13 | 13 | 83 | 67 | 23 | 13 | 19.3 | 65.7 | 72.3 | 43.5 |
| | | | 18 | 23 | 19 | 18 | 12 | 13 | 12 | 12 | | 45 | 25 | 12 | | 44.4 | | 52.0 |
| 60 | 62 | 49 | 68 | 79 | 49 | 43 | 31 | 25 | 19 | 23 | 87 | 70 | 57 | 24 | 19.6 | 18.6 | 34.5 | 59.6 |
| 33 | 20 | 19 | 7 | 9 | 24 | 11 | 21 | 6 | 9 | 11 | 78 | 63 | 18 | 12 | 19.2 | 71.5 | 77.0 | 33.3 |
| 18 | 24 | 23 | 15 | 17 | 20 | 11 | 17 | 10 | 6 | 14 | 41 | 22 | 17 | 12 | 46.4 | 22.7 | 58.6 | 29.4 |
| 18 | 21 | 19 | 14 | 14 | 30 | 17 | 11 | 10 | 11 | 8 | | 32 | 18 | 10 | | 43.8 | | 44.5 |
| 41 | 46 | 34 | 42 | 35 | 33 | 41 | 28 | 61 | 56 | 34 | | 41 | 40 | 45 | | 2.5 | | +11.1 |
| 17 | 14 | 23 | 30 | 26 | 17 | 21 | 46 | 19 | 23 | 11 | 32 | 25 | 21 | 25 | 21.9 | 16.0 | 34.4 | +16.0 |
| 41 | 40 | 24 | 33 | 26 | 18 | 20 | 58 | 11 | 11 | 12 | | 53 | 33 | 23 | | 37.8 | | 30.3 |
| 70 | 55 | 71 | 74 | 85 | 62 | 53 | 48 | 51 | 29 | 37 | 70 | 51 | 61 | 41 | 30.0 | +19.6 | 15.7 | 32.8 |
| 23 | 14 | 14 | 18 | 24 | 12 | 11 | 13 | 10 | 7 | 8 | 54 | 41 | 18 | 9 | 24.1 | 56.7 | 66.7 | 50.0 |
| 50 | 21 | 8 | 10 | 13 | 23 | 23 | 22 | 23 | 18 | 10 | 38 | 30 | 25 | 18 | 21.0 | 16.7 | 34.3 | 28.0 |
| 37 | 27 | 43 | 54 | 30 | 34 | 20 | 18 | 23 | 24 | 13 | 38 | 30 | 40 | 19 | 21.0 | +33.3 | + 5.3 | 52.5 |
| 41 | 37 | 33 | 30 | 56 | 31 | 25 | 32 | 30 | 13 | 17 | | 35 | 39 | 23 | | 10.2 | | 41.0 |
| 17 | 17 | 16 | 15 | 17 | 12 | 12 | 12 | 11 | 10 | 7 | 27 | 19 | 17 | 10 | 35.0 | 10.5 | 37.1 | 41.2 |
| 21 | 43 | 36 | 26 | 28 | 18 | 7 | 13 | 13 | 19 | 12 | | 37 | 23 | 14 | | 26.4 | | 39.1 |
| 11 | 17 | 25 | 28 | 24 | 22 | 31 | 89 | 17 | 12 | 7 | | | 23 | 34 | | | | +32.0 |
| 22 | 7 | 14 | 4 | 11 | 10 | 5 | 7 | 5 | 7 | 8 | | 34 | 15 | 7 | | 44.1 | | 53.3 |
| | | | | | | | | | | | | | | | | | | |
| 73 | 55 | 51 | 75 | 60 | 36 | 22 | 17 | 14 | 12 | 16 | 68 | 47 | 49 | 14 | 30.9 | + 4.3 | 28.0 | 71.4 |
| 136 | 139 | 108 | 141 | 135 | 53 | 13 | 12 | 10 | 6 | 10 | 108 | 88 | 113 | 12 | 18.5 | +35.2 | +4.6 | |
| 32 | 28 | 42 | 16 | 19 | 38 | 24 | 55 | 35 | 38 | 15 | | 33 | 28 | 35 | | 15.1 | | +20.0 |
| 36 | 26 | 35 | 25 | 22 | 24 | 20 | 23 | 18 | 17 | 7 | | | 27 | 16 | | | | 40.8 |
| 20 | 15 | 20 | 19 | 8 | 16 | 12 | 17 | 14 | 10 | 11 | 62 | 32 | 18 | 13 | 50.0 | 42.0 | 71.0 | 27.7 |
| 32 | 33 | 26 | 40 | 47 | 54 | 37 | 32 | 23 | 28 | 59 | 44 | 48 | 44 | 35 | | 8.3 | | 25.0 |
| 73 | 54 | 45 | 47 | 41 | 50 | 24 | 22 | 17 | 15 | 20 | 75 | 47 | 55 | 18 | 37.3 | +14.9 | 26.7 | 67.2 |
| 12 | 16 | 12 | 17 | 16 | 12 | 9 | 14 | 11 | 12 | 9 | 34 | 27 | 14 | 11 | 20.6 | 25.9 | 58.8 | 21.4 |
| 52 | 38 | 23 | 18 | 16 | 15 | 15 | 13 | 10 | 13 | 17 | 38 | 34 | 28 | 13 | 10.4 | 17.6 | 26.3 | 53.5 |
| 10 | 14 | 11 | 21 | 17 | 12 | 20 | 20 | 10 | 9 | 9 | 114 | 33 | 15 | 12 | 71.5 | 54.6 | 86.8 | 20.0 |
| 62 | 50 | 44 | 29 | 51 | 33 | 41 | 50 | 53 | 41 | 21 | 108 | 64 | 52 | 41 | 40.7 | 18.7 | 51.8 | 21.2 |
| 25 | 31 | 24 | — | 57 | 27 | 17 | 15 | 16 | 14 | 16 | 46 | 33 | 31 | 15 | 28.2 | 6.1 | 32.7 | 51.6 |
| 54 | 79 | 40 | 41 | 84 | 25 | 25 | 24 | 43 | 29 | 43 | | | 45 | 35 | | | | 22.2 |
| 18 | 11 | 17 | 11 | 76 | 11 | 11 | 14 | 12 | 9 | 9 | 42 | 38 | 24 | 11 | 9.4 | 36.9 | 42.9 | 54.1 |
| 37 | 37 | 36 | 20 | 48 | 22 | 23 | 14 | 10 | 8 | 5 | | | 32 | 9 | | | | 71.9 |
| 14 | 18 | 13 | 14 | 17 | 12 | 9 | 10 | 8 | 6 | 7 | 31 | 37 | 14 | 8 | +19.4 | 62.2 | 54.8 | 42.8 |
| 88 | 80 | 86 | 98 | 38 | 40 | 32 | 32 | 37 | 17 | 7 | | | 63 | 23 | | | | 63.5 |
| 23 | 15 | 27 | 21 | 29 | 29 | 14 | 15 | 18 | 17 | 21 | 56 | 51 | 23 | 18 | 8.8 | 55.0 | 59.0 | 21.7 |
| 8 | 12 | 8 | 12 | 14 | | | 39 | 32 | 14 | 27 | | | | 28 | | | | |
| 18 | 18 | 17 | 10 | 16 | 15 | 12 | 28 | 15 | 16 | 13 | | 34 | 16 | 18 | | 53.0 | | +11.1 |
| 30 | 37 | 46 | 45 | 36 | 40 | 31 | 37 | 22 | 31 | 42 | | 34 | 37 | 33 | | + 8.8 | | 10.7 |
| 60 | 43 | 25 | 35 | 79 | 52 | 32 | 50 | 44 | 39 | 21 | 41 | 28 | 42 | 38 | 31.7 | +50.0 | +2.4 | 9.5 |
| 36 | 50 | 51 | 34 | 28 | 35 | 22 | 20 | 27 | 19 | 16 | | 57 | 52 | 20 | | 8.8 | | 61.5 |
| 18 | 18 | 13 | 27 | 19 | 20 | 15 | 7 | 12 | 6 | 11 | 29 | 22 | 19 | 9 | 24.1 | 13.4 | 34.4 | 52.7 |
| 49 | 47 | 48 | 52 | 36 | 39 | 33 | 25 | 22 | 23 | 16 | 74 | 78 | 52 | 24 | + 5.4 | 33.3 | 29.8 | 53.8 |
| | | | 31 | 45 | 23 | 14 | 37 | 12 | 17 | 13 | | | | 20 | | | | |
| 95 | 51 | 36 | 46 | 40 | 25 | 30 | 38 | 28 | 30 | 23 | 72 | 49 | 47 | 30 | 31.8 | 4.1 | 34.7 | 36.2 |
| 15 | 6 | 21 | 11 | 14 | 10 | 8 | 16 | 7 | 3 | 3 | 28 | 21 | 15 | 7 | 24.9 | 27.8 | 46.5 | 53.3 |

TABLE 21

*Typhoid fever deaths in the registration states, seasonal distribution (1910)*

| STATE | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| California | 21 | 19 | 24 | 27 | 31 | 55 | 43 | 50 | 55 | 49 | 47 | 39 |
| Colorado | 10 | 16 | 6 | 11 | 6 | 14 | 23 | 34 | 44 | 85 | 69 | 19 |
| Connecticut | 5 | 6 | 7 | 6 | 6 | 9 | 7 | 22 | 24 | 32 | 26 | 15 |
| Dist. Columbia | 3 | 4 | 6 | 5 | 5 | 4 | 6 | 10 | 13 | 8 | 8 | 5 |
| Indiana | 52 | 33 | 36 | 35 | 29 | 26 | 43 | 127 | 177 | 173 | 121 | 67 |
| Maine | 14 | 3 | 11 | 12 | 9 | 6 | 12 | 17 | 26 | 16 | 14 | 11 |
| Maryland | 25 | 25 | 28 | 25 | 13 | 16 | 25 | 72 | 100 | 79 | 72 | 48 |
| Massachusetts | 20 | 30 | 15 | 24 | 25 | 28 | 27 | 48 | 70 | 52 | 49 | 33 |
| Michigan | 32 | 43 | 43 | 30 | 27 | 22 | 29 | 74 | 106 | 120 | 86 | 55 |
| Minnesota | 28 | 57 | 72 | 40 | 15 | 19 | 21 | 56 | 106 | 108 | 96 | 50 |
| Montana | 3 | 1 | 4 | 7 | 2 | 10 | 5 | 23 | 31 | 34 | 22 | 9 |
| New Hampshire | 3 | 2 | 5 | 3 | 4 | 2 | 2 | 7 | 6 | 2 | 6 | 4 |
| New Jersey | 13 | 12 | 19 | 21 | 20 | 33 | 33 | 45 | 59 | 49 | 34 | 33 |
| New York | 91 | 92 | 97 | 74 | 66 | 72 | 100 | 142 | 185 | 174 | 168 | 136 |
| North Carolina* | 6 | 2 | 4 | 1 | 7 | 19 | 49 | 37 | 32 | 26 | 18 | 8 |
| Ohio | 74 | 60 | 65 | 68 | 67 | 41 | 68 | 145 | 202 | 233 | 167 | 124 |
| Pennsylvania | 130 | 124 | 138 | 125 | 91 | 78 | 80 | 208 | 275 | 284 | 208 | 151 |
| Rhode Island | 4 | 3 | 7 | 3 | 0 | 1 | 8 | 8 | 11 | 11 | 11 | 7 |
| Utah | 4 | 1 | 4 | 6 | 3 | 6 | 13 | 10 | 30 | 26 | 19 | 17 |
| Vermont | 5 | 5 | 1 | 6 | 2 | 3 | 1 | 5 | 4 | 10 | 5 | 3 |
| Washington | 22 | 10 | 12 | 9 | 17 | 11 | 24 | 45 | 44 | 45 | 50 | 35 |
| Wisconsin | 55 | 31 | 46 | 29 | 37 | 46 | 38 | 34 | 56 | 60 | 67 | 45 |

* Includes only municipalities having populations of 1000 or over in 1900.

## TABLE 22

*Typhoid fever deaths in the registration states, seasonal distribution (1911)*

| STATE | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| California | 40 | 33 | 23 | 26 | 35 | 39 | 43 | 33 | 43 | 45 | 44 | 26 |
| Colorado | 18 | 10 | 8 | 11 | 8 | 21 | 32 | 41 | 30 | 34 | 28 | 11 |
| Connecticut | 7 | 12 | 3 | 4 | 4 | 4 | 15 | 23 | 22 | 37 | 15 | 8 |
| Dist. Columbia | 6 | 4 | 4 | 3 | 8 | 2 | 5 | 11 | 7 | 6 | 8 | 11 |
| Indiana | 42 | 42 | 35 | 46 | 30 | 29 | 76 | 109 | 90 | 99 | 76 | 54 |
| Kentucky | 39 | 41 | 64 | 43 | 49 | 83 | 145 | 167 | 116 | 133 | 107 | 82 |
| Maine | 10 | 11 | 13 | 12 | 9 | 8 | 9 | 11 | 14 | 12 | 12 | 14 |
| Maryland | 22 | 11 | 23 | 18 | 22 | 19 | 25 | 78 | 89 | 84 | 73 | 27 |
| Massachusetts | 12 | 13 | 20 | 16 | 15 | 17 | 18 | 35 | 49 | 43 | 42 | 31 |
| Michigan | 40 | 42 | 50 | 44 | 35 | 34 | 44 | 52 | 56 | 64 | 47 | 39 |
| Minnesota | 21 | 18 | 23 | 20 | 10 | 11 | 17 | 24 | 23 | 37 | 52 | 27 |
| Missouri | 49 | 40 | 43 | 37 | 31 | 63 | 126 | 177 | 141 | 160 | 129 | 63 |
| Montana | 7 | 3 | 1 | 5 | 6 | 7 | 8 | 9 | 9 | 14 | 5 | 6 |
| New Hampshire | 13 | 5 | 2 | 5 | 3 | 0 | 3 | 4 | 8 | 8 | 5 | 7 |
| New Jersey | 22 | 28 | 16 | 15 | 23 | 15 | 32 | 30 | 42 | 32 | 29 | 31 |
| New York | 97 | 90 | 94 | 80 | 78 | 75 | 116 | 167 | 154 | 148 | 117 | 104 |
| North Carolina | 10 | 4 | 5 | 1 | 7 | 33 | 57 | 40 | 34 | 38 | 23 | 10 |
| Ohio | 81 | 59 | 66 | 58 | 53 | 52 | 71 | 108 | 158 | 174 | 144 | 77 |
| Pennsylvania | 143 | 176 | 125 | 101 | 92 | 89 | 88 | 174 | 199 | 223 | 168 | 138 |
| Rhode Island | 1 | 0 | 2 | 2 | 4 | 2 | 4 | 12 | 7 | 9 | 4 | 6 |
| Utah | 9 | 3 | 4 | 4 | 4 | 2 | 3 | 7 | 10 | 15 | 9 | 4 |
| Vermont | 4 | 1 | 3 | 0 | 6 | 3 | 2 | 3 | 8 | 6 | 1 | 7 |
| Washington | 23 | 14 | 7 | 5 | 14 | 22 | 19 | 25 | 32 | 22 | 30 | 10 |
| Wisconsin | 32 | 20 | 14 | 28 | 23 | 19 | 21 | 25 | 24 | 32 | 48 | 25 |

TABLE 23

*Typhoid fever deaths in the registration states, seasonal distribution (1912)*

| STATE | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| California | 29 | 19 | 26 | 25 | 25 | 36 | 55 | 57 | 42 | 44 | 47 | 35 |
| Colorado | 5 | 5 | 4 | 5 | 8 | 7 | 12 | 9 | 29 | 24 | 14 | 10 |
| Connecticut | 7 | 4 | 8 | 7 | 13 | 7 | 13 | 13 | 16 | 14 | 9 | 15 |
| Dist. Columbia | 8 | 2 | 1 | 4 | 2 | 2 | 10 | 9 | 15 | 12 | 8 | 6 |
| Indiana | 29 | 43 | 41 | 32 | 35 | 32 | 33 | 70 | 97 | 107 | 80 | 46 |
| Kentucky | 49 | 44 | 34 | 43 | 54 | 31 | 71 | 93 | 91 | 127 | 88 | 67 |
| Maine | 15 | 9 | 6 | 9 | 8 | 5 | 4 | 9 | 13 | 9 | 7 | 9 |
| Maryland | 26 | 16 | 22 | 23 | 8 | 7 | 31 | 44 | 54 | 48 | 39 | 49 |
| Massachusetts | 18 | 10 | 12 | 15 | 15 | 26 | 20 | 29 | 33 | 34 | 30 | 27 |
| Michigan | 40 | 34 | 50 | 49 | 41 | 40 | 44 | 43 | 54 | 68 | 34 | 42 |
| Minnesota | 24 | 16 | 18 | 17 | 20 | 18 | 14 | 22 | 20 | 29 | 21 | 9 |
| Missouri | 42 | 35 | 51 | 28 | 32 | 35 | 49 | 98 | 127 | 121 | 92 | 61 |
| Montana | 7 | 2 | 1 | 8 | 2 | 2 | 4 | 8 | 10 | 3 | 4 | 6 |
| New Hampshire | 4 | 6 | 1 | 2 | 5 | 3 | 0 | 2 | 4 | 3 | 2 | 6 |
| New Jersey | 22 | 22 | 14 | 13 | 11 | 19 | 19 | 51 | 34 | 36 | 33 | 35 |
| New York | 109 | 64 | 69 | 71 | 83 | 73 | 77 | 121 | 138 | 143 | 86 | 73 |
| North Carolina | 7 | 2 | 4 | 6 | 1 | 14 | 24 | 25 | 30 | 15 | 15 | 12 |
| Ohio | 58 | 58 | 81 | 55 | 56 | 44 | 54 | 91 | 107 | 112 | 101 | 76 |
| Pennsylvania | 131 | 110 | 99 | 81 | 62 | 65 | 92 | 126 | 148 | 171 | 119 | 106 |
| Rhode Island | 2 | 0 | 1 | 1 | 4 | 3 | 2 | 5 | 7 | 11 | 5 | 3 |
| Utah | 2 | 1 | 2 | 1 | 0 | 6 | 4 | 5 | 13 | 12 | 8 | 3 |
| Vermont | 6 | 3 | 6 | 2 | 4 | 4 | 3 | 3 | 5 | 1 | 1 | 2 |
| Washington | 7 | 16 | 9 | 11 | 10 | 3 | 14 | 12 | 27 | 20 | 17 | 13 |
| Wisconsin | 47 | 31 | 35 | 24 | 25 | 16 | 14 | 10 | 31 | 28 | 21 | 27 |

TABLE 24

*Typhoid fever deaths in the registration states, seasonal distribution (1913)*

| STATE | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| California............ | 29 | 19 | 18 | 19 | 25 | 34 | 47 | 51 | 43 | 51 | 55 | 33 |
| Colorado............. | 6 | 7 | 4 | 2 | 7 | 8 | 9 | 22 | 22 | 32 | 16 | 15 |
| Connecticut.......... | 4 | 7 | 6 | 3 | 8 | 6 | 17 | 23 | 23 | 13 | 15 | 8 |
| Dist. Columbia ...... | 4 | 4 | 4 | 2 | 3 | 5 | 7 | 9 | 2 | 11 | 2 | 4 |
| Indiana.............. | 26 | 26 | 26 | 28 | 32 | 26 | 48 | 115 | 95 | 128 | 85 | 58 |
| Kentucky............ | 52 | 52 | 47 | 31 | 36 | 65 | 131 | 153 | 136 | 119 | 111 | 65 |
| Maine............... | 6 | 4 | 8 | 7 | 10 | 10 | 3 | 2 | 14 | 12 | 12 | 3 |
| Maryland............ | 19 | 19 | 27 | 10 | 19 | 28 | 48 | 82 | 63 | 55 | 43 | 30 |
| Massachusetts....... | 12 | 22 | 11 | 9 | 17 | 15 | 24 | 37 | 47 | 40 | 23 | 22 |
| Michigan............ | 44 | 31 | 35 | 37 | 31 | 28 | 42 | 47 | 72 | 68 | 62 | 42 |
| Minnesota........... | 19 | 16 | 16 | 9 | 6 | 6 | 16 | 15 | 23 | 50 | 36 | 23 |
| Missouri............. | 42 | 30 | 24 | 32 | 34 | 37 | 84 | 158 | 131 | 108 | 85 | 55 |
| Montana............. | 5 | 6 | 7 | 6 | 3 | 3 | 6 | 5 | 14 | 14 | 13 | 13 |
| New Hampshire...... | 6 | 3 | 1 | 3 | 1 | 3 | 8 | 2 | 6 | 5 | 10 | 4 |
| New Jersey.......... | 14 | 10 | 14 | 10 | 16 | 15 | 28 | 36 | 44 | 39 | 31 | 8 |
| New York............ | 53 | 46 | 52 | 45 | 64 | 48 | 72 | 105 | 126 | 168 | 121 | 99 |
| North Carolina....... | 8 | 4 | 5 | 10 | 8 | 21 | 46 | 45 | 34 | 23 | 13 | 11 |
| Ohio................. | 51 | 51 | 55 | 67 | 77 | 65 | 106 | 176 | 181 | 177 | 106 | 79 |
| Pennsylvania........ | 92 | 84 | 65 | 81 | 105 | 97 | 111 | 173 | 201 | 196 | 137 | 128 |
| Rhode Island........ | 3 | 4 | 4 | 2 | 0 | 5 | 1 | 3 | 9 | 10 | 4 | 3 |
| Virginia............. | 26 | 19 | 30 | 15 | 30 | 70 | 109 | 106 | 118 | 99 | 44 | 43 |
| Utah................. | 0 | 2 | 2 | 3 | 2 | 4 | 12 | 10 | 10 | 20 | 10 | 15 |
| Vermont............. | 1 | 3 | 3 | 2 | 1 | 0 | 3 | 0 | 3 | 4 | 3 | 5 |
| Washington.......... | 5 | 4 | 9 | 2 | 5 | 6 | 9 | 13 | 32 | 17 | 15 | 22 |
| Wisconsin............ | 23 | 17 | 19 | 21 | 21 | 12 | 12 | 15 | 24 | 22 | 15 | 16 |

TABLE 25

*Typhoid fever deaths in the registration states, seasonal distribution (average for years 1910–1913 inclusive)*

| STATE | ESTIMATED AVERAGE POPULATION | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| California........... | 2,478,000 | 30 | 23 | 23 | 24 | 29 | 41 | 47 | 48 | 46 | 47 | 48 | 33 |
| Colorado............ | 828,000 | 10 | 9 | 5 | 7 | 8 | 13 | 19 | 27 | 31 | 44 | 32 | 14 |
| Connecticut......... | 1,138,000 | 6 | 7 | 6 | 5 | 8 | 7 | 13 | 20 | 21 | 25 | 16 | 12 |
| Dist. Columbia...... | 340,000 | 5 | 4 | 4 | 4 | 4 | 3 | 7 | 10 | 12 | 9 | 7 | 6 |
| Indiana............. | 2,721,000 | 37 | 36 | 35 | 35 | 31 | 28 | 50 | 105 | 105 | 127 | 90 | 56 |
| Kentucky*.......... | 2,322,000 | 47 | 46 | 48 | 39 | 46 | 60 | 116 | 138 | 114 | 126 | 102 | 71 |
| Maine............... | 748,000 | 11 | 7 | 9 | 10 | 9 | 7 | 7 | 10 | 17 | 12 | 11 | 9 |
| Maryland........... | 1,307,000 | 23 | 18 | 25 | 19 | 15 | 18 | 32 | 69 | 76 | 61 | 57 | 38 |
| Massachusetts....... | 3,429,000 | 15 | 19 | 15 | 16 | 18 | 21 | 22 | 37 | 50 | 42 | 36 | 28 |
| Michigan............ | 2,454,000 | 39 | 38 | 44 | 40 | 34 | 31 | 40 | 54 | 72 | 80 | 57 | 44 |
| Minnesota........... | 2,112,000 | 23 | 27 | 32 | 21 | 13 | 14 | 17 | 29 | 43 | 56 | 51 | 27 |
| Missouri*........... | 3,335,000 | 44 | 35 | 39 | 32 | 32 | 45 | 90 | 144 | 133 | 130 | 102 | 60 |
| Montana............ | 391,000 | 5 | 3 | 3 | 6 | 3 | 6 | 6 | 11 | 16 | 16 | 11 | 9 |
| New Hampshire..... | 433,000 | 7 | 4 | 2 | 3 | 3 | 2 | 3 | 4 | 6 | 5 | 6 | 5 |
| New Jersey.......... | 2,612,000 | 18 | 18 | 16 | 15 | 18 | 21 | 28 | 41 | 45 | 39 | 32 | 27 |
| New York........... | 9,320,000 | 88 | 73 | 78 | 70 | 73 | 67 | 91 | 134 | 151 | 158 | 123 | 103 |
| North Carolina...... | 373,000 | 8 | 3 | 4 | 5 | 6 | 22 | 44 | 37 | 32 | 25 | 17 | 10 |
| Ohio................ | 4,835,000 | 66 | 57 | 67 | 62 | 63 | 51 | 75 | 130 | 162 | 174 | 129 | 89 |
| Pennsylvania........ | 7,867,000 | 124 | 124 | 107 | 97 | 88 | 82 | 93 | 173 | 206 | 220 | 158 | 131 |
| Rhode Island........ | 556,000 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 7 | 8 | 10 | 6 | 5 |
| Utah................ | 384,000 | 4 | 2 | 3 | 3 | 2 | 5 | 8 | 8 | 16 | 18 | 12 | 10 |
| Vermont............ | 358,000 | 4 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 5 | 5 | 3 | 4 |
| Virginia†............ | 2,129,000 | 26 | 19 | 30 | 15 | 30 | 70 | 109 | 106 | 118 | 99 | 44 | 43 |
| Washington......... | 1,211,000 | 14 | 11 | 9 | 7 | 11 | 11 | 16 | 24 | 34 | 26 | 31 | 20 |
| Wisconsin........... | 2,363,000 | 39 | 25 | 29 | 25 | 26 | 23 | 21 | 21 | 34 | 36 | 38 | 28 |

* 1911–1913 inclusive.

† 1913

## TABLE 26

*Typhoid fever deaths in large American cities, seasonal distribution (1910)*

| CITY | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltimore, Md. | 7 | 13 | 10 | 4 | 2 | 8 | 8 | 34 | 46 | 41 | 37 | 25 |
| Boston, Mass. | 2 | 3 | 1 | 2 | 7 | 1 | 5 | 8 | 16 | 7 | 17 | 7 |
| Buffalo, N. Y. | 7 | 10 | 2 | 8 | 10 | 2 | 4 | 11 | 5 | 10 | 8 | 10 |
| Chicago, Ill. | 21 | 12 | 17 | 14 | 13 | 14 | 22 | 33 | 44 | 36 | 48 | 26 |
| Cincinnati, O. | 2 | 1 | 1 | 2 | 3 | 1 | 4 | 4 | 8 | 4 | 1 | 1 |
| Cleveland, O. | 10 | 6 | 5 | 13 | 7 | 2 | 4 | 4 | 15 | 15 | 10 | 10 |
| Detroit, Mich. | 4 | 6 | 7 | 2 | 4 | 3 | 5 | 20 | 22 | 12 | 14 | 9 |
| Jersey City, N. J. | 0 | 0 | 2 | 0 | 1 | 2 | 2 | 5 | 8 | 5 | 5 | 1 |
| Los Angeles, Cal. | 1 | 4 | 1 | 4 | 1 | 5 | 5 | 4 | 5 | 6 | 5 | 5 |
| Milwaukee, Wis. | 22 | 15 | 18 | 12 | 17 | 28 | 17 | 9 | 12 | 10 | 9 | 3 |
| Minneapolis, Minn. | 13 | 31 | 42 | 23 | 5 | 2 | 4 | 11 | 21 | 10 | 11 | 5 |
| Newark, N. J. | 2 | 1 | 2 | 3 | 2 | 2 | 4 | 8 | 10 | 5 | 4 | 3 |
| New Orleans, La. | 5 | 8 | 7 | 7 | 5 | 13 | 12 | 13 | 14 | 9 | 7 | 7 |
| New York, N. Y. | 35 | 28 | 31 | 24 | 26 | 39 | 53 | 65 | 65 | 78 | 63 | 49 |
| Philadelphia, Pa. | 47 | 31 | 24 | 21 | 12 | 12 | 8 | 16 | 31 | 35 | 14 | 21 |
| Pittsburgh, Pa. | 7 | 11 | 19 | 12 | 10 | 10 | 8 | 15 | 13 | 17 | 10 | 17 |
| St. Louis, Mo. | 5 | 4 | 9 | 3 | 9 | 2 | 5 | 12 | 20 | 12 | 14 | 8 |
| San Francisco, Cal. | 1 | 2 | 5 | 6 | 5 | 10 | 3 | 9 | 10 | 6 | 6 | 2 |
| Washington, D. C. | 3 | 4 | 6 | 5 | 5 | 4 | 6 | 10 | 13 | 8 | 8 | 5 |

## TABLE 27

*Typhoid fever deaths in large American cities, seasonal distribution (1911)*

| CITY | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltimore, Md. | 11 | 3 | 5 | 8 | 7 | 8 | 4 | 27 | 29 | 27 | 19 | 8 |
| Boston, Mass. | 2 | 3 | 5 | 3 | 3 | 3 | 4 | 6 | 11 | 8 | 10 | 2 |
| Buffalo, N. Y. | 6 | 12 | 12 | 7 | 7 | 4 | 11 | 15 | 13 | 7 | 12 | 3 |
| Chicago, Ill. | 16 | 17 | 15 | 12 | 20 | 17 | 25 | 27 | 25 | 26 | 19 | 26 |
| Cincinnati, O. | 3 | 3 | 4 | 1 | 1 | 3 | 6 | 6 | 5 | 3 | 6 | 2 |
| Cleveland, O. | 8 | 3 | 4 | 9 | 5 | 8 | 3 | 7 | 18 | 8 | 7 | 2 |
| Detroit, Mich. | 4 | 6 | 2 | 5 | 5 | 4 | 12 | 10 | 9 | 10 | 5 | 6 |
| Jersey City, N. J. | 1 | 0 | 0 | 1 | 0 | 3 | 1 | 5 | 3 | 2 | 1 | 3 |
| Los Angeles, Cal. | 4 | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 6 | 5 | 6 | 3 |
| Milwaukee, Wis. | 6 | 4 | 4 | 8 | 6 | 3 | 10 | 8 | 4 | 3 | 15 | 4 |
| Minneapolis, Minn. | 1 | 2 | 5 | 1 | 1 | 1 | 0 | 2 | 2 | 5 | 12 | 5 |
| Newark, N. J. | 1 | 3 | 0 | 2 | 2 | 2 | 4 | 4 | 6 | 7 | 3 | 4 |
| New Orleans, La. | 7 | 3 | 11 | 2 | 9 | 16 | 17 | 14 | 6 | 10 | 6 | 6 |
| New York, N. Y. | 28 | 21 | 23 | 18 | 26 | 32 | 55 | 85 | 80 | 65 | 57 | 48 |
| Philadelphia, Pa. | 18 | 16 | 17 | 15 | 11 | 10 | 16 | 30 | 29 | 23 | 19 | 26 |
| Pittsburgh, Pa. | 16 | 15 | 12 | 8 | 4 | 12 | 8 | 11 | 14 | 8 | 19 | 12 |
| St. Louis, Mo. | 5 | 4 | 6 | 3 | 4 | 8 | 18 | 23 | 14 | 11 | 13 | 4 |
| San Francisco, Cal. | 8 | 5 | 1 | 3 | 7 | 6 | 0 | 1 | 11 | 8 | 10 | 5 |
| Washington, D. C. | 6 | 4 | 4 | 3 | 8 | 2 | 5 | 11 | 7 | 6 | 8 | 11 |

TABLE 28

*Typhoid fever deaths in large American cities, seasonal distribution (1912)*

| CITY | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltimore, Md. | 11 | 6 | 11 | 10 | 3 | 4 | 15 | 22 | 19 | 11 | 9 | 19 |
| Boston, Mass. | 5 | 2 | 1 | 2 | 1 | 8 | 3 | 9 | 9 | 9 | 4 | 4 |
| Buffalo, N. Y. | 8 | 2 | 1 | 5 | 9 | 4 | 4 | 3 | 3 | 2 | 3 | 8 |
| Chicago, Ill. | 11 | 7 | 8 | 18 | 8 | 14 | 10 | 23 | 24 | 20 | 13 | 14 |
| Cincinnati, O. | 1 | 2 | 1 | 5 | 4 | 2 | 1 | 6 | 3 | 3 | 0 | 2 |
| Cleveland, O. | 2 | 0 | 0 | 4 | 5 | 3 | 5 | 3 | 4 | 8 | 4 | 3 |
| Detroit, Mich. | 3 | 5 | 1 | 6 | 6 | 1 | 10 | 15 | 10 | 19 | 4 | 8 |
| Jersey City, N. J. | 0 | 1 | 1 | 1 | 0 | 4 | 2 | 2 | 2 | 4 | 3 | 2 |
| Los Angeles, Cal. | 2 | 2 | 3 | 7 | 5 | 6 | 3 | 13 | 3 | 6 | 7 | 1 |
| Milwaukee, Wis. | 24 | 13 | 16 | 6 | 9 | 6 | 5 | 1 | 9 | 3 | 4 | 7 |
| Minneapolis, Minn. | 3 | 4 | 1 | 5 | 5 | 2 | 1 | 4 | 5 | 3 | 5 | 0 |
| Newark, N. J. | 2 | 5 | 1 | 2 | 2 | 3 | 0 | 7 | 0 | 1 | 3 | 4 |
| New Orleans, La. | 2 | 2 | 0 | 4 | 1 | 7 | 2 | 6 | 7 | 2 | 8 | 8 |
| New York, N. Y. | 42 | 30 | 24 | 20 | 17 | 35 | 38 | 66 | 78 | 66 | 44 | 27 |
| Philadelphia, Pa. | 40 | 14 | 10 | 11 | 11 | 12 | 25 | 22 | 22 | 15 | 9 | 14 |
| Pittsburgh, Pa. | 7 | 8 | 10 | 5 | 7 | 5 | 6 | 8 | 6 | 6 | 3 | 1 |
| St. Louis, Mo. | 2 | 3 | 5 | 3 | 3 | 3 | 8 | 15 | 11 | 12 | 8 | 3 |
| San Francisco, Cal. | 7 | 5 | 1 | 2 | 1 | 6 | 11 | 8 | 4 | 5 | 3 | 6 |
| Washington, D. C. | 8 | 2 | 1 | 4 | 2 | 2 | 10 | 9 | 15 | 12 | 8 | 6 |

TABLE 29

*Typhoid fever deaths in large American cities, seasonal distribution (1913)*

| CITY | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltimore, Md. | 6 | 12 | 8 | 3 | 6 | 9 | 15 | 23 | 22 | 19 | 8 | 6 |
| Boston, Mass. | 4 | 8 | 4 | 0 | 1 | 2 | 3 | 5 | 11 | 14 | 5 | 2 |
| Buffalo, N. Y. | 6 | 3 | 3 | 4 | 7 | 3 | 5 | 7 | 5 | 13 | 6 | 7 |
| Chicago, Ill. | 7 | 18 | 12 | 13 | 16 | 15 | 8 | 22 | 24 | 36 | 44 | 28 |
| Cincinnati, O. | 3 | 2 | 2 | 1 | 2 | 2 | 4 | 3 | 3 | 4 | 0 | 1 |
| Cleveland, O. | 3 | 2 | 5 | 8 | 12 | 5 | 6 | 10 | 11 | 11 | 8 | 7 |
| Detroit, Mich. | 8 | 12 | 5 | 11 | 15 | 10 | 16 | 13 | 25 | 15 | 15 | 8 |
| Jersey City, N. J. | 1 | 0 | 2 | 2 | 3 | 4 | 3 | 4 | 6 | 2 | 3 | 1 |
| Los Angeles, Cal. | 3 | 3 | 3 | 1 | 3 | 1 | 6 | 2 | 4 | 8 | 10 | 6 |
| Milwaukee, Wis. | 3 | 6 | 5 | 6 | 4 | 3 | 5 | 1 | 4 | 4 | 3 | 2 |
| Minneapolis, Minn. | 1 | 1 | 4 | 2 | 2 | 1 | 5 | 1 | 5 | 4 | 7 | 7 |
| Newark, N. J. | 1 | 0 | 3 | 0 | 1 | 2 | 6 | 5 | 6 | 5 | 4 | 0 |
| New Orleans, La. | 4 | 2 | 3 | 1 | 0 | 5 | 8 | 13 | 7 | 4 | 8 | 5 |
| New York, N. Y. | 13 | 15 | 19 | 14 | 14 | 16 | 26 | 38 | 54 | 75 | 50 | 29 |
| Philadelphia, Pa. | 14 | 5 | 9 | 13 | 29 | 32 | 26 | 44 | 26 | 20 | 21 | 18 |
| Pittsburgh, Pa. | 7 | 6 | 7 | 5 | 8 | 5 | 9 | 13 | 19 | 10 | 5 | 15 |
| St. Louis, Mo. | 9 | 3 | 3 | 8 | 2 | 4 | 14 | 19 | 19 | 18 | 15 | 8 |
| San Francisco, Cal. | 6 | 3 | 1 | 4 | 5 | 9 | 10 | 5 | 7 | 5 | 9 | 7 |
| Washington, D. C. | 4 | 4 | 4 | 2 | 3 | 5 | 7 | 9 | 2 | 11 | 2 | 4 |

### TABLE 30

*Typhoid fever deaths in large American cities, seasonal distribution. (Averages for years 1910–1913 inclusive)*

| CITY | ESTIMATED AVERAGE POPULATION | JAN. | FEB. | MCH. | APRIL | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltimore, Md....... | 567,000 | 9 | 9 | 8 | 6 | 5 | 7 | 11 | 26 | 29 | 25 | 18 | 15 |
| Boston, Mass........ | 700,000 | 3 | 4 | 3 | 2 | 3 | 4 | 4 | 7 | 12 | 10 | 9 | 4 |
| Buffalo, N. Y........ | 437,000 | 7 | 7 | 5 | 6 | 9 | 3 | 6 | 9 | 7 | 8 | 7 | 7 |
| Chicago, Ill.......... | 2,265,000 | 16 | 14 | 13 | 14 | 17 | 15 | 16 | 26 | 29 | 30 | 31 | 24 |
| Cincinnati, O........ | 385,000 | 2 | 2 | 2 | 2 | 3 | 2 | 4 | 5 | 5 | 3 | 2 | 1 |
| Cleveland, O......... | 588,000 | 6 | 3 | 3 | 9 | 7 | 4 | 5 | 6 | 12 | 11 | 7 | 5 |
| Detroit, Mich........ | 498,000 | 5 | 7 | 4 | 6 | 7 | 4 | 11 | 15 | 17 | 14 | 10 | 8 |
| Jersey City, N. J.... | 279,000 | 1 | 0 | 1 | 1 | 1 | 3 | 2 | 4 | 5 | 3 | 3 | 2 |
| Los Angeles, Cal..... | 358,000 | 2 | 2 | 2 | 4 | 3 | 4 | 4 | 5 | 5 | 6 | 7 | 4 |
| Milwaukee, Wis...... | 398,000 | 14 | 10 | 11 | 8 | 9 | 10 | 9 | 5 | 7 | 5 | 8 | 4 |
| Minneapolis, Minn... | 317,000 | 5 | 9 | 13 | 8 | 3 | 2 | 2 | 4 | 8 | 6 | 9 | 4 |
| Newark, N. J........ | 366,000 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 6 | 5 | 4 | 4 | 3 |
| New Orleans, La..... | 348,000 | 4 | 7 | 5 | 4 | 4 | 10 | 10 | 12 | 8 | 6 | 7 | 7 |
| New York, N. Y..... | 5,011,000 | 30 | 24 | 24 | 19 | 21 | 31 | 43 | 64 | 69 | 66 | 54 | 38 |
| Philadelphia, Pa..... | 1,593,000 | 30 | 16 | 15 | 15 | 16 | 17 | 19 | 28 | 27 | 23 | 16 | 20 |
| Pittsburgh, Pa....... | 547,000 | 9 | 10 | 12 | 8 | 7 | 8 | 8 | 12 | 13 | 10 | 9 | 11 |
| St. Louis, Mo........ | 707,000 | 5 | 4 | 6 | 4 | 5 | 4 | 11 | 17 | 16 | 13 | 12 | 6 |
| San Francisco, Cal... | 430,000 | 5 | 4 | 2 | 4 | 5 | 8 | 6 | 6 | 8 | 6 | 7 | 5 |
| Washington, D. C.... | 340,000 | 5 | 4 | 4 | 4 | 4 | 3 | 7 | 10 | 9 | 9 | 7 | 7 |

TABLE 31

*White and colored typhoid fever death rate (1910)*

| CITY | DEATHS FROM TYPHOID FEVER | | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION LIVING | | | PER CENT WHICH WHITE DEATH RATE WAS OF TOTAL TYPHOID DEATH RATE |
|---|---|---|---|---|---|---|
| | White | Colored | White | Colored | Total | |
| Atlanta, Ga. | 58 | 20 | 56.3 | 38.5 | 50.1 | 111.3 |
| Baltimore, Md. | 193 | 42 | 40.7 | 49.6 | 42.0 | 97.0 |
| Birmingham, Ala. | 40 | 26 | 50.0 | 49.8 | 49.5 | 101.0 |
| Boston, Mass. | 75 | 1 | 11.4 | 7.4 | 11.3 | 101.0 |
| Chicago, Ill. | 289 | 11 | 13.5 | 25.0 | 13.7 | 98.7 |
| Cincinnati, O. | 30 | 2 | 8.7 | 10.0 | 8.8 | 98.9 |
| Cleveland, O. | 98 | 3 | 17.8 | 35.6 | 17.9 | 99.3 |
| Columbus, O. | 30 | 3 | 17.8 | 23.6 | 18.1 | 98.5 |
| Indianapolis, Ind. | 62 | 5 | 29.2 | 22.9 | 28.5 | 102.3 |
| Kansas City, Mo. | 117 | 19 | 52.1 | 80.7 | 54.4 | 95.8 |
| Los Angeles, Cal. | 44 | 2 | 14.1 | 26.4 | 14.2 | 99.4 |
| Louisville, Ky. | 44 | 27 | 24.1 | 66.7 | 31.7 | 76.2 |
| Memphis, Tenn. | 15 | 21 | 19.0 | 40.1 | 27.4 | 69.4 |
| Nashville, Tenn. | 37 | 17 | 50.0 | 46.6 | 48.9 | 102.1 |
| New Orleans, La. | 67 | 40 | 26.8 | 44.8 | 31.5 | 85.3 |
| New York, N. Y. | 541 | 15 | 11.6 | 16.3 | 11.7 | 99.2 |
| Philadelphia, Pa. | 241 | 31 | 16.5 | 36.7 | 17.5 | 94.4 |
| Pittsburgh, Pa. | 142 | 7 | 28.0 | 27.3 | 27.8 | 100.5 |
| Portland, Ore. | 44 | 3 | 21.4 | 291.7 | 22.4 | 95.7 |
| Richmond, Va. | 15 | 13 | 18.6 | 27.8 | 21.9 | 85.1 |
| St. Louis, Mo. | 94 | 9 | 14.6 | 20.5 | 14.9 | 98.2 |
| San Francisco, Cal. | 62 | 3 | 14.9 | 183.0 | 15.5 | 96.3 |
| Seattle, Wash. | 32 | 2 | 13.6 | 87.0 | 14.2 | 95.9 |
| Washington, D. C. | 45 | 32 | 19.0 | 33.9 | 23.2 | 82.0 |

TABLE 32

*White and colored typhoid fever death rate (1911)*

| CITY | DEATHS FROM TYPHOID FEVER | | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION LIVING | | | PER CENT WHICH WHITE DEATH RATE WAS OF TOTAL TYPHOID DEATH RATE |
|---|---|---|---|---|---|---|
| | White | Colored | White | Colored | Total | |
| Atlanta, Ga. | 62 | 44 | 58.2 | 81.8 | 66.1 | 88 |
| Baltimore, Md. | 124 | 32 | 25.9 | 37.2 | 27.6 | 93 |
| Birmingham, Ala. | 35 | 27 | 42.4 | 50.3 | 45.5 | 93 |
| Boston, Mass. | 58 | 2 | 8.6 | 13.1 | 8.7 | 99 |
| Chicago, Ill. | 241 | 4 | 10.9 | 8.4 | 10.9 | 100 |
| Cincinnati, O. | 41 | 2 | 11.5 | 9.8 | 11.4 | 100 |
| Cleveland, O. | — | — | — | — | — | — |
| Columbus, O. | 25 | 1 | 7.6 | 14.4 | 13.9 | 54 |
| Indianapolis, Ind. | 55 | 7 | 25.3 | 31.2 | 25.8 | 98 |
| Kansas City, Mo. | 67 | 10 | 28.8 | 40.7 | 29.9 | 96 |
| Los Angeles, Cal. | 35 | 5 | 10.6 | 33.5 | 11.6 | 91 |
| Louisville, Ky. | 33 | 21 | 17.7 | 51.0 | 23.7 | 74 |
| Memphis, Tenn. | 43 | 44 | 53.9 | 82.6 | 65.4 | 82 |
| Nashville, Tenn. | 38 | 22 | 51.0 | 59.7 | 53.9 | 94 |
| New Orleans, La. | 59 | 48 | 23.2 | 52.6 | 31.0 | 75 |
| New York, N. Y. | 991 | 20 | 14.4 | 16.3 | 14.4 | 100 |
| Philadelphia, Pa. | 218 | 12 | 14.6 | 13.7 | 14.6 | 100 |
| Pittsburgh, Pa. | 133 | 6 | 25.8 | 22.8 | 25.6 | 100 |
| Portland, Ore. | 39 | 3 | 18.5 | 34.2 | 19.1 | 97 |
| Richmond, Va. | 16 | 7 | 19.5 | 14.8 | 17.8 | 109 |
| St. Louis, Mo. | 104 | 9 | 15.9 | 19.8 | 16.1 | 98 |
| San Francisco, Cal. | 55 | 10 | 13.5 | 58.0 | 15.3 | 88 |
| Seattle, Wash. | — | — | — | — | — | — |
| Washington, D. C. | 47 | 28 | 19.5 | 28.9 | 22.2 | 87 |

TABLE 33

*White and colored typhoid fever death rate (1912)*

| CITY | DEATHS FROM TYPHOID FEVER | | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION LIVING | | | PER CENT WHICH WHITE DEATH RATE WAS OF TOTAL TYPHOID DEATH RATE |
|---|---|---|---|---|---|---|
| | White | Colored | White | Colored | Total | |
| Atlanta, Ga.......... | 38 | 32 | 34.2 | 57.1 | 41.9 | 81 |
| Baltimore, Md....... | 114 | 26 | 23.6 | 30.0 | 24.6 | 95 |
| Birmingham, Ala.... | 33 | 23 | 36.3 | 38.8 | 37.3 | 97 |
| Boston, Mass......... | 55 | 2 | 7.9 | 12.9 | 8.0 | 98 |
| Chicago, Ill.......... | 162 | 8 | 7.2 | 16.5 | 7.4 | 97 |
| Cincinnati, O........ | 27 | 3 | 7.4 | 14.3 | 7.7 | 96 |
| Cleveland, O......... | — | — | — | — | — | — |
| Columbus, O......... | 34 | 4 | 18.9 | 29.3 | 19.6 | 96 |
| Indianapolis, Ind.... | 40 | 4 | 17.9 | 17.3 | 17.8 | 100 |
| Kansas City, Mo.... | 30 | 2 | 29.0 | 49.9 | 32.4 | 89 |
| Los Angeles, Cal.... | 52 | 6 | 14.1 | 35.7 | 15.0 | 94 |
| Louisville, Ky....... | 31 | 19 | 16.5 | 45.8 | 21.8 | 75 |
| Memphis, Tenn...... | 34 | 47 | 41.3 | 85.4 | 58.9 | 70 |
| Nashville, Tenn..... | 17 | 20 | 22.5 | 53.6 | 32.8 | 68 |
| New Orleans, La.... | 30 | 19 | 11.6 | 20.5 | 14.0 | 83 |
| New York, N. Y.... | 476 | 11 | 11.2 | 14.3 | 11.3 | 99 |
| Philadelphia, Pa..... | 192 | 13 | 12.7 | 14.6 | 12.8 | 99 |
| Pittsburgh, Pa....... | 70 | 2 | 13.4 | 7.5 | 13.1 | 102 |
| Portland, Ore........ | 38 | 1 | 16.9 | 10.7 | 16.6 | 102 |
| Richmond, Va........ | 16 | 6 | 19.2 | 12.5 | 16.7 | 114 |
| St. Louis, Mo........ | 64 | 12 | 9.6 | 26.0 | 10.7 | 89 |
| San Francisco, Cal.. | 54 | 5 | 13.0 | 28.5 | 13.6 | 95 |
| Seattle, Wash........ | — | — | — | — | — | — |
| Washington, D. C... | 49 | 30 | 20.0 | 30.5 | 23.0 | 87 |

### TABLE 34

*White and colored typhoid fever death rate (1913)*

| CITY | DEATHS FROM TYPHOID FEVER | | TYPHOID FEVER DEATH RATE PER 100,000 POPULATION LIVING | | | PER CENT WHICH WHITE DEATH RATE WAS OF TOTAL TYPHOID DEATH RATE |
|---|---|---|---|---|---|---|
| | White | Colored | White | Colored | Total | |
| Atlanta, Ga. | 21 | 17 | 18.2 | 29.2 | 21.9 | 83 |
| Baltimore, Md. | 93 | 44 | 19.1 | 50.3 | 23.8 | 80 |
| Birmingham, Ala. | 27 | 30 | 28.2 | 48.1 | 36.0 | 78 |
| Boston, Mass. | 58 | 1 | 8.2 | 6.3 | 8.2 | 100 |
| Chicago, Ill. | 237 | 6 | 10.3 | 12.1 | 10.4 | 99 |
| Cincinnati, O. | 24 | 3 | 6.4 | 13.9 | 6.8 | 94 |
| Cleveland, O. | — | — | — | — | — | — |
| Columbus, O. | 35 | 3 | 18.9 | 21.3 | 19.1 | 98 |
| Indianapolis, Ind. | 52 | 10 | 22.6 | 42.1 | 24.4 | 92 |
| Kansas City, Mo. | 51 | 9 | 20.6 | 34.4 | 21.9 | 94 |
| Los Angeles, Cal. | 45 | 5 | 11.4 | 27.9 | 12.1 | 94 |
| Louisville, Ky. | 37 | 17 | 19.4 | 40.3 | 23.2 | 83 |
| Memphis, Tenn. | 28 | 20 | 33.3 | 35.6 | 34.2 | 97 |
| Nashville, Tenn. | 30 | 12 | 39.4 | 31.8 | 36.9 | 106 |
| New Orleans, La. | 38 | 22 | 14.5 | 23.4 | 16.9 | 85 |
| New York, N. Y. | 356 | 7 | 7.0 | 6.6 | 7.0 | 100 |
| Philadelphia, Pa. | 229 | 28 | 14.9 | 31.0 | 15.7 | 94 |
| Pittsburgh, Pa. | 101 | 8 | 19.0 | 29.6 | 19.5 | 97 |
| Portland, Ore. | 16 | — | 6.8 | — | 6.5 | 104 |
| Richmond, Va. | 18 | 9 | 21.3 | 18.4 | 20.3 | 104 |
| St. Louis, Mo. | 107 | 15 | 15.8 | 32.0 | 16.9 | 93 |
| San Francisco, Cal. | 66 | 5 | 15.6 | 28.0 | 16.1 | 96 |
| Seattle, Wash. | — | — | — | — | — | — |
| Washington, D. C. | 35 | 22 | 14.1 | 22.0 | 16.4 | 86 |